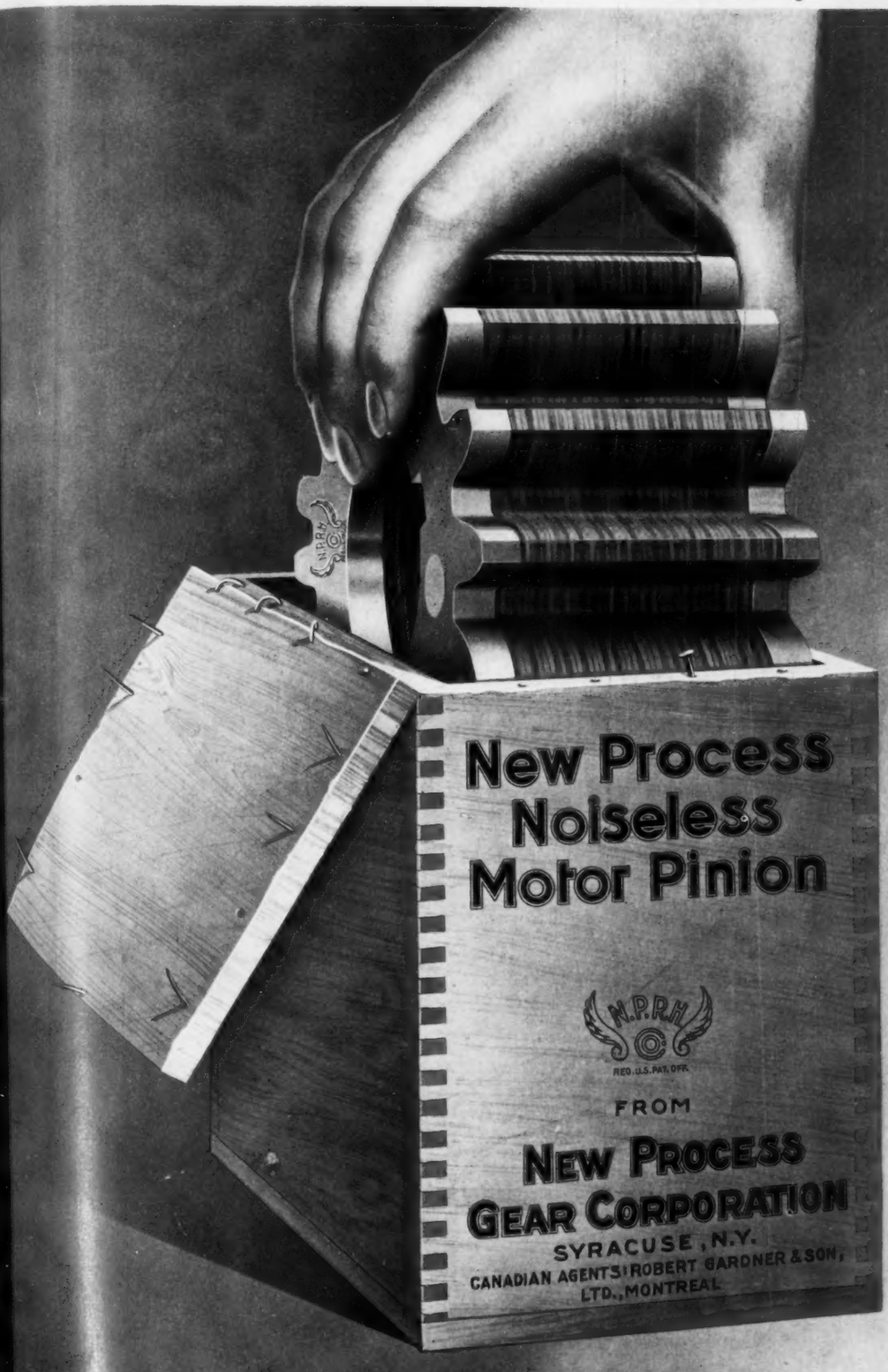
Efficient Employees as an Element in Costs—*Experience in Heating Hous*
Electricity, Flood-lighting the Woolworth Tower, and other articles on commercial illumination practic

Engineering Library

Electrical World

New York, August 26, 1916 McGraw Publishing Co., Inc. Vol. 68, No. 9 10c a copy



Dont condemn your noisy motors!

Send for new Process Pinions to replace the noisy metal ones. Permanent quiet with disappearance of destructive vibration will reward your good judgment.

Weston

For Maximum Efficiency Look to the Specialist

Proverbially, the Jack of All Trades Is Master of None.

No individual or organization, devoting its energies to many different purposes, can equal in each instance the results attained by the specialist who masters one particular subject and hence becomes an expert.

So, in the field of Electrical Measurement, there are not and never have been any Indicating Instruments to compare with

WESTON
Portable and Switchboard
INDICATING INSTRUMENTS
For A.C. and D.C. Circuits

From the very beginning to the present, practically every improvement in the Art of Electrical Measurement as it is known today has originated with this Company. To convince yourself of Weston superiority, you have only to compare the interior of any Weston Instrument with any instrument of other make. In accuracy, in serviceability, in durability, in legibility, Weston Instruments far surpass all others.

No Engineer, when considering switchboard equipment, can afford to allow any considerations to prevent his specifying Weston Indicating Instruments. Whoever supplies the balance of the equipment, Weston Instruments should be specified.

You owe it to yourself to become posted regarding the vast superiority of these Weston Instruments. Write us for any special information or ask for the Bulletin or Catalog describing any group—A. C. or D. C., Switchboard or Portable—which interests you.

New York
Boston
Philadelphia
Pittsburgh
Buffalo
Richmond
Cincinnati
Cleveland
St. Louis
Chicago
Detroit

Home Office and Factory
13 Weston Ave.
Waverly Park, Newark, N. J.

Denver
San Francisco
Toronto
Montreal
Winnipeg
Johannesburg, S. Africa
Vancouver
London
Petrograd
Paris
Florence

Weston Electrical Instrument Co.

Electrical World

The consolidation of Electrical World and Engineer and American Electrician.
Published by McGraw Publishing Company, Inc.

Vol. 68 NEW YORK, SATURDAY, AUGUST 26, 1916 No. 9

Lower Rates Minus Higher Wages

ELECTRICAL utilities have a profound interest in the diplomatic struggle over the threatened railroad strike. They are concerned first over the question of their coal supply, which vitally endangers their ability to render service; second, they would like to preserve the principle of arbitration in the settlement of such grave issues as the one involved, and third, they cannot disguise their feeling that a governmental program which assumes a moral control over wages is highly dangerous unless at the same time it takes responsibility for rates. To establish higher wages without making higher rates is to take money out of the pocket without providing the means of putting it back. Costs belong to the consumer. Higher taxes, wage advances, greater interest on capital, increases in material prices are passed on in most industries, to the user of the product. It may not arouse his unbounded enthusiasm, but he sees about him all of the signs of a more expensive scale of living and he takes it as a part of life that he cannot alter. But when it comes to the case of the utility, the public asks and it receives freely at the hands of the regulating commission. Rates are crowded down. The definite tendency when the authorities touch the problem of wages, is to force an advance in the schedule. If the right hand which raises the wages does not tell what it is doing to the left hand which lowers the rates, the result will be disastrous. Co-ordinate the two functions. Do not let the one which increases the outgo escape responsibility also for the income and the scales will be balanced.

Greater Facilities for Manufacturing

INCREASED facilities for the manufacture of electrical apparatus and appliances are an inevitable development of the present business situation. At the beginning of the war there were no signs of the enormous demand for electrical machinery which developed later. Additional manufacturing facilities were not justified by the outlook. Even when the momentum of the new prosperity began to gather force the caution bred by the danger of war restricted expansion. The tendency was to use existing plants to the fullest possible extent, but to avoid undue expansion. This feeling arose from the apprehension of a severe industrial setback for this country after the conclusion of the war across the seas. Even now, when orders are reaching the manufacturers in a volume which is still very high, there is a disposition not to make undue haste in carrying out expansion plans which increase the permanent investment. But the facts which are before the manufacturers as to the large and unsatisfied demands for their products by domestic consumers point indubitably to the necessity for comprehensive schemes of enlargement in the future. Not only home consumption but foreign markets will require greater output of American made electrical apparatus and appliances. As examples, there may be cited the fact that the turbine manufacturing capacity for large units is sold ahead for about a year. Another indication is the state of almost famine which was developed in the small motor field by the condition of supply and demand. To point to another similar circumstance, the popularity of electric ranges is making heavy demands upon the manufacturers. Then there is the important consideration that industrial machinery generally is being subjected to extraordinarily heavy usage, and will need renewal in a shorter time than would be required under ordinary conditions. Also the rate of central station growth promises more than the common scale of enlargement in the physical properties. Upon this showing of facts it is clear that a prediction of increased manufacturing facilities has ample justification.

An Experiment in Residence Heating

ELECTRIC heating in the larger sense has made comparatively little progress. It has been confined for the most part wholly to auxiliary work in furnishing for special purposes a moderate amount of heat over limited intervals. Almost every house, with whatever heating system it may be equipped, has one or two rooms that are conspicuously difficult to keep at the proper temperature. Electric radiators have been used to a limited extent to fill the gap thus created, and in rather mild climates, where cheap electrical supply from water power is available, they have also been employed with some degree of success to supply the modest amount of heat necessary.

So far as we remember, however, the paper by Mr. Ross, which we publish this week, is the first study of house heating on a considerable scale which has yet appeared, and, as such, it is particularly well worth attention. The scene of the experiment was Seattle, a city which, without having a severe climate, affords a typical example of the heating requirements of the north temperate zone. Beginning with auxiliary work on a comparatively small scale, the Seattle experiments grew into a real study of the possibilities of the case from the standpoint both of the householder and the central station. The houses tried were of good construction and moderate size, initially equipped with hot water radiation systems. Two years' experience

with the houses thus equipped has given pretty definite information as to the general economics of the situation. In rough terms, the consumption for the complete heating of a house during the year ran from 40,000 kw.-hr. to 60,000 kw.-hr. Two of the buildings were two-story, nine-room houses, the others being slightly smaller in number of rooms, but still typical of medium-sized residences. Sufficient data has now been accumulated to permit planning similar installations with a fairly good idea of the conditions and results to be expected.

Now, starting from the approximate consumption found to be necessary, the economic side of the situation is developed automatically. At 1 cent per kilowatt hour, the heating bill per annum would run roughly to $500 on a moderate-sized residence. Even at 0.5 cent per kilowatt-hour, the heating cost would reach $250, which is evidently largely in excess of the cost of direct heating by coal taken at its ordinary price, of from $6 to $7.50 per ton. Even with energy at 0.5 cent per unit, the cost of electrical heating would run to nearly one and one-half times that of heating by coal, while even at the low rate of 1 cent, this figure would be doubled.

These relative figures are closely checked by a consideration of the cost of the thermal energy in British thermal units reckoned in each process. If this were the whole story the hopelessness of house heating, except in very peculiar situations where the cost of coal is abnormally high, would be self-evident. With coal at $10 or $12 a ton, a figure not infrequently reached locally on account of transportation difficulties, and at the same time with cheap hydroelectric power available, electric heating would come sufficiently near being economical to be attractive.

Some modified schemes were tried with a view to decreasing the average consumption of energy while obtaining practically the desired results. A number of installations were made with oil-filled, hot-water radiators, each independently heated by a cartridge type coil. In this way there is complete utilization of the heat without losses from piping. Each room can be heated and regulated independently, and the initial cost of installation, supposing one were to start with electric heating, would be somewhat reduced. As a matter of fact, it is seldom necessary in any house to heat all the rooms all the time even at a comparatively low-working temperature, and there seems little doubt that such a system of individual units might effect considerable economy. The same would be true of the use of ordinary electric radiators under similar circumstances with, however, the disadvantage that the storage capacity is negligibly small compared with that of a radiator, so that an off-peak scheme could not be so successfully worked. Oil-filled radiators would very likely be able to tide over the extreme peak with fair success, although probably unable to cope with the long peak already mentioned.

To sum up the situation, it looks from these experiments as though for continuous house heating off-peak energy must be had at 0.5 cent per kilowatt-hour to make electric house heating feasible from the standpoint of the householder, even allowing for the advantage of no fires to tend, no ashes to care for, and a minimum of trouble in every way. This is in strong contrast with electric cooking where a 2-cent rate seems to bring conditions of real competitive costs, but this ratio is about what one would expect considering the relatively low efficiency of the range as compared with a well-arranged hot-water heating system.

An intermediate rate would probably open up a certain amount of auxiliary heating on which experiments are perhaps worth trying. For example, if a medium-sized house were equipped through its main living rooms with a hot-water system, and fitted with electric radiators in the apartments less frequently used, there would be a certain saving due to working the ordinary heater at its maximum efficiency which would, in part, recoup the intrinsically higher cost of the electric service. Such details as these deserve to be thrashed out, but the general result of Mr. Ross' experiments tallies well with those tried elsewhere in showing as a general proposition the conditions of economy, at present prices of fuel, to be rather hopelessly against electric heating on a large scale even when it is arranged as an off-peak load. The special applications in auxiliary service are another story, as the growing use of the electric range indicates.

Service Stations for Electric Vehicles

THERE is more electrical equipment and electrical wiring on a modern gas car to-day than there is on an electric. What with lighting, starting and ignition systems and, more recently, electric gear shift and speed control, the electrical engineering involved in the design and maintenance of the gas car has reached a development not always realized. This elaboration of electrical equipment at first seems to take advantage of the primary values of the electrical vehicle, and so to have stolen a march on its development. This is by no means true. There is reason to believe, indeed, that the advantages in comfort, convenience and utility which are inherent in the electric, and which by adding electrical equipment the gas car has taken unto itself, will make possible the growth of the electric and widen the market in the immediate future. The heart of the vehicle problem is the battery. The battery needs care and attention not necessarily expert, but regular and experienced. The storage battery is essential for obtaining the advantages which the gas car has borrowed from the electric. Gas car manufacturers have taken the initiative in establishing service stations where all the equipment can be inspected and overhauled. This has resulted recently in the development of local specialists in storage-battery maintenance. Service stations for electrical equipment only are springing up. That the electric car may take advantage of this service is apparent. More important is the fact that since this movement is just starting there seems a real opportunity for a new business in a town. The combined electrical needs of gas car and electric car users will support a

business. The local electrical interests should take advantage of this specialization and take the initiative to see that the local specialists in battery maintenance exercise to the fullest the new opportunity.

Transmission Line Ground Wires

IT HAS long been known in telegraphic line-wire experience, both here and in Europe, that when a number of telegraph wires were carried on the same poles, the circuits of the lower and central wires were less likely to be injured by lightning than those of the upper and outer wires. It has also been gradually demonstrated in American power transmission practice that ground wires carried on the same towers as the working wires help to protect the latter from lightning disturbances. It is not surprising, indeed, that this protective influence should exist, since we know that if the working wires were incased in a large metallic envelop, or in a grounded tube, it would be impossible to set up lightning disturbances over the working wires within by any kind of electric pyrotechnics over the outer tube. A ground wire or set of wires is an early stage of such an ideal enveloping grounded metallic tube. It has not been known, however, just what degree of lightning protection was afforded by an overhead ground wire or group of wires, and when their expense was warranted.

An excellent paper, opening up the avenue for solving this problem on the theoretical side, was presented by Dr. E. E. F. Creighton before the last convention of the A. I. E. E. The effects of overhead ground wires were discussed in a very interesting way. Doctor Creighton usefully employed for this purpose the electrostatic system of units, which are much better adapted to the work than the so-called practical units. The paper pointed out that the electrostatic screening effect on the working conductors of a single ground wire is partly reduced by electromagnetic surging over the latter. For this reason, two ground wires, one on each side of the working wire, behave better, because they co-operate in their electrostatic shielding, and at the same time they oppose each other electromagnetically, so that the induced surges are diminished. A certain amount of resistance in the grounding risers may also help to damp out the surges. The size of the overhead ground wires should also be reduced to the lowest consistent with ample self-supporting mechanical strength. The deductions support the use not only of grounded wires, but also of several small grounded wires of great tensile strength, surrounding the working conductors, whenever the maintenance of uninterrupted service is of considerable importance.

A Spectacular Feat of Flood-Lighting

THERE are few buildings in the world which from the standpoint of scenic effect lend themselves better to flood-lighting than the Woolworth tower in New York City. It was a happy inspiration to carry out on this immense structure so brilliant a piece of illumination. From a technical standpoint it was not an easy proposition, on account of the extraordinary height of the structure and the difficulty of getting proper locations for the flood-lights at a reasonable distance from the surfaces they are to illuminate. It is not surprising that when this task was undertaken no suitable projectors were available, but the demand promptly created them, and the result was a lighting unit of good efficiency giving a beam which could be successfully used from a near-by point. In addition it was found desirable to use silvered glass as the reflecting medium, which required still further modification of the projector design. The amount of light required was enough to take care of a moderate-sized city. A total of 550 projectors, each fitted with a 250-watt, gas-filled lamp, have gone into the equipment, and in addition twenty-four 1000-watt lamps connected to an automatic dimmer are located in the lanterns at the extreme top of the structure. As our readers well know, the surface of the tower is light colored, so that it formed a favorable object for flood-lighting, but to obtain the requisite intensity, particularly at the top of the tower, required an allotment of energy of from 0.75 watt to 3 watts per square foot, the intensity increasing from bottom to top by as regular gradation as could be conveniently obtained. As a spectacular feat of flood-lighting the illumination of the Woolworth tower will hold the first place for a long time to come, and it is doubtful whether for striking effect it can be surpassed.

The Coming Issues

MARKING the opening of the fall lighting season and the renewal of local activity throughout the electrical industry, in preparation for autumn and winter business, the ELECTRICAL WORLD for Sept. 2 will present the first group of a series of articles on the design, installation and operation of downtown and residential street-lighting systems, to appear in this and following numbers. One article planned for next week's issue will deal in particular with street-lighting developments resulting from the Panama-Pacific International Exposition. Another important feature of the same number will be a survey of the equipment, service and rates for street lighting in representative American cities, as shown by a statistical compilation of equipment and conditions of service in more than 100 cities ranging from metropolitan rank to communities of 15,000 population. Few men in the electrical industry realize the extent and scope of the industry. A special article on "Mobilizing the Industry" puts the statistical facts about the greater electrical industry in a new light. It has a timely interest in connection with America's Electrical Week. A method of protecting telephone lines in the vicinity of transmission circuits, against potential disturbances due to lighting and high-voltage sources, will be the subject of a leading article in the station-operating number of the ELECTRICAL WORLD for Sept. 9. The second issue of ELECTRICAL MERCHANDISING, the new monthly magazine which extends to the electrical trade the editorial service of the ELECTRICAL WORLD, appeared last week under date of Aug. 15.

Chronicle of Events of the Industry and of Important Movements in the Field

NEWS OF THE WEEK

Reports of Conventions and Meetings of Electrical Associations and Societies

MUNICIPAL ELECTRICIANS MEET

Twenty-first Annual Convention Held This Week at Baltimore—Addresses by Dr. Steinmetz, Herbert A. Wagner, and Others

On the hottest day that Baltimore has experienced in a number of years delegates of the International Association of Municipal Electricians began on Tuesday last at the Royal Arcanum Building, Baltimore, Md., the first day of the association's twenty-first annual convention.

Mayor Preston was scheduled to make an address of welcome, but was unable to be present and was represented by his secretary, Robert E. Lee. Dr. Charles P. Steinmetz, vice-president of the association, in replying to Mr. Lee's address spoke of how closely Baltimore was allied with the history and development of all things electrical.

The opening exercises concluded with the address of President W. H. Flandreau of Mount Vernon, N. Y. Mr. Flandreau touched on several points which he considered would be advantageous to the association, and which, he said, would be considered later on by the convention. Among these were the feasibility of concentric wiring and the necessity for securing the best possible material for the construction of police and fire alarm telegraphs.

Control of "Wireless"

That a grave problem confronts the government in the control of amateur housetop wireless aerials was the tenor of the address of R. D. Duncan, Jr., assistant physicist of the Bureau of Standards. Of the many problems that the amateur operators have created most of them have been solved. Every one is cataloged and accounted for by the government, but there remains one important difficulty—how to prevent their interference with interior house wiring and with signal lines. That problem, said Mr. Duncan, the government experts have not solved; in fact, have not attempted to solve, but they undoubtedly will give it thorough research.

The necessity for a national standard for all electric wiring was urged in an address by R. A. Smith, chief electrician of Norfolk in order that fires and loss of life from defective wiring might be reduced to a minimum. It seemed to be the sense of the convention that the awarding of contracts for municipal electrical work by city officials more concerned in making political tenstrikes than in the safety and convenience of the city should be stopped, and all contractors compelled to fulfill certain requirements.

Robert Moran of Memphis told the convention that the adoption of the National Electrical Code in his city had proven a success, and had the co-operation of municipal officials and electrical contractors.

President Flandreau declared that the association was the logical organization to decide upon and fix a standard, and it is probable that this will be one of the convention's most important works.

At the reception tendered on Tuesday evening to the delegates by the Baltimore section of the National Electric Light Association, Dr. Steinmetz pointed out that the beginning of a complete reconstruction of American ideals necessary to the retention of this nation's place as a world power must be in greater co-operation between industrial and municipal corporations. Herbert A. Wagner, president of the N.E.L.A., who followed Dr. Steinmetz, opened the way for an understanding between municipal and industrial corporations when he said, on behalf of the electric light association:

"The fair corporation welcomes fair regulation. Every fair industry wants to co-operate with municipalities, and the National Electric Light Association will follow any co-operative idea in the interest of the public." Moving pictures of the gas centenary pageant preceded the addresses and a buffet luncheon followed.

The Wednesday session was opened by Dr. Steinmetz with a paper on "Electric Power and Its Value to a Municipality."

PRESIDENT FLANDREAU

The technical program of the convention was arranged as follows:

Tuesday—"Concentric Wiring," by C. W. Abbott, Pittsburgh, Pa.; "Wireless Interference with Signal Lines and Interior Wiring," by W. J. Canada, Bureau of Standards, Washington, D. C.; "The National Code and Its Value to Our Association," by R. A. Smith, Norfolk, Va.; "Rubber Insulation for Electrical Purposes," by Dr. Whipple, chief chemist, Safety Wire & Cable Company.

Wednesday—"Electric Power and Its Value to a Municipality," by Dr. Charles P. Steinmetz, vice-president of the association; "Modern Municipal Electrical Plants," by Frank Dix, superintendent municipal plant, Fort Wayne, Ind. Report of committee on municipal lighting; report of committee on grounding.

Thursday—"The Electrical Fire Hazard," by F. H. Moore, president Western Association Electrical Inspectors; "Street Signals and Traffic Warnings in Connection with Fire Apparatus," by L. S. Brach, Newark, N. J.; "Standardization," Engineering Department National Lamp Works, Cleveland, Ohio; report of finance committee; report of executive committee; report of membership committee; "The Fire Alarm System," by C. I. Diehl, Harrisburg, Pa.; "Police Signaling," by John W. Kelly, Camden, N. J.

Friday—"Standard Specifications Covering the Con-

struction at Overhead Crossings of Lines of Public Utilities in Pennsylvania," by Dr. F. Herbert Snow, chief of bureau of engineers Public Service Commission of Pennsylvania; report of committee on high voltage; report of committee on national electrical safety code; address by Dr. John Price Jackson, commissioner of labor and industry, Pennsylvania; report of committee on exhibits; report of committee on publicity; report of committee on electrolysis; report of committee on licensing electricians; report of committee on standard construction of municipal signaling circuits.

New York Edison Company Rate Case Reopened

Rates of the New York Edison Company are again before the Public Service Commission of the First District for consideration. At a meeting of the commission on Aug. 23, Commissioner Whitney moved that the entire question be reopened and it will be brought before the commission on Sept. 7. This action is the result of a petition filed with the commission by Dr. Milo R. Maltbie, city chamberlain, on behalf of Mayor Mitchel. This asked that the present order, allowing the company to charge until May 1, 1918, a maximum of 8 cents per kilowatt-hour be changed and the limit shortened to July 1, 1917. Commissioner Whitney, however, has added to this a motion that rates also be considered.

Commissioner Whitney stated that from time to time there have been criticisms of the order of the commission and that on various occasions consideration had been given to the matter of reopening the proceedings as to the three-year limit and the amount of the rate. He added:

"As it would have consumed a considerable period of time to get the data ready, including the valuation of the property, it was thought that the commission could consider the matter so as to be ready for a determination either before or at the end of the three years.

"In respect to the valuation it is to be noted that, although the original case consumed several years, no valuation was made by the commission of the property of the company, a step that would seem to be necessary in any rate case."

Mayor Mitchel says that the earnings of the company for 1915 available for interest and dividends have not been decreased to the amount considered reasonable by the majority of the commission who voted in favor of the present order, which was adopted on March 16, 1915.

The case affects also the United Electric Light & Power Company.

The rate case of the New York Edison Company before the commission had its beginning in 1911. Hearings were held until Dec. 9, 1912, before Dr. Maltbie, who was then a member of the commission. Later Dr. Maltbie filed an opinion in the case and hearings were resumed in 1914. In October, 1914, the company asked for a reopening of the case and further hearings were started. At the meeting of the commission on March 5, 1915, Commissioner Cram moved that the maximum rate be made 8 cents per kilowatt-hour. Commissioner Maltbie recommended a maximum of 6½ cents per kilowatt-hour for lighting and general use and of 6 cents for power. Commissioners McCall and Williams concurred with the suggestion of Commissioner Cram. The order as adopted provides that the maximum rate, exclusive of the installation and renewal of lamps, shall be 8 cents per kilowatt-hour, excepting for Kingsbridge and a section of the Bronx lying east of the Bronx River.

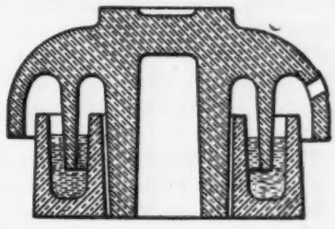
Dr. William McClellan Becomes Dean of Pennsylvania School of Commerce

Announcement has been made by Provost Smith of the University of Pennsylvania that Dr. William McClellan, consulting engineer of New York City and former chief engineer for the New York public service commission for the second district, has been appointed dean of the Wharton School of Finance and Commerce of the University of Pennsylvania, one of the principal undergraduate departments, with more than 2000 students. Dr. McClellan has been in business for the last eleven years but previous to that had spent a number of years in university and preparatory school teaching.

This is the first time that an American university has turned to the business world to fill such a position. Provost Smith explained, however, that this did not signify any radical departure in the conduct of the Wharton School, but that it seemed wise to select a man of wide business experience for the head of its school of finance and commerce, who was at the same time a graduate, holding degrees from three other departments of the university.

An Insulator Support for Sulphuric Acid Batteries

The Gould Storage Battery Company of New York discloses a means for effectually stopping the passage of leakage currents due to the insulating surfaces be-



INSULATOR SUPPORT FOR SULPHURIC ACID BATTERIES

coming covered with the sulphuric acid used in the storage batteries. In a patent (No. 1,190,766) assigned to it by Albert S. Hubbard, an insulator having a skirt and a receptacle are proposed, in which receptacle, oil or other insulating medium is contained.

N. E. L. A. Committee on Wiring

There will be a meeting of the wiring committee of the Commercial Section of the National Electric Light Association on Sept. 19 in New York City. The committee desires to consider other systems of wiring in addition to the concentric, which hold forth any promise of increasing the safety without increasing the cost, or of decreasing the cost without decreasing the safety. At least two such systems have been called to the attention of the committee, and at its meeting on Sept. 19 the committee will consider what it can do and what the central station industry can do toward having these systems tried out, and then approved if they shall be found satisfactory.

The committee also desires to consider any other methods, and would be glad if those who are interested in such systems or who have knowledge of them would submit the data that would be necessary for the committee to take further action.

Any communications may be addressed to chairman, P. S. Hale, either at his office, 39 Boylston Street, Boston, or the N. E. L. A. headquarters in New York.

PENNSYLVANIA ELECTRIC ASSOCIATION CONVENTION

Program and Entertainment Features of Ninth Annual Meeting, to Be Held at Eagles Mere Park, September 5, 6, 7 and 8

Forest Inn, Eagles Mere Park, Pa., will be the scene of the ninth annual convention of the Pennsylvania Electric Association to be held on Sept. 5, 6, 7 and 8. Convention activities will begin on Wednesday morning, Sept. 6, with an address by President Stephen C. Pohe, of Bloomsburg. Following this address reports will be heard from the convention committees, executive committee, secretary and treasurer, and the committees on by-laws, membership, accounting, and safety and welfare. Three papers will be presented at this session namely: "Construction Records and Accounts," by H. C. Hopson, The Wilkes-Barre Company; "Construction of Cost Accounting," by F. Heinbokel, Warren Light & Power Company; "Classification of Materials and Supplies," by W. P. McArdle, Duquesne Light Company.

Two papers will be presented at the Thursday morning session, one on "Method of Securing the Consumer Deterred by First Cost of Wiring," by E. C. Newman of the West Penn Power Company, and the other entitled "Increased Use of Electric Ranges and Small Appliances in the Home," by H. W. Reed of Altoona. W. J. Norton, a member of the rate research committee of the National Electric Light Association, the parent organization, will address the convention on "Rate Research." George B. Muldaur, traveling secretary of the N. E. L. A., will also address this session. Reports will be presented by the committee on geographic sections, of which E. D. Dreyfus is chairman, and by the committee on municipal street lighting, E. H. Davis, chairman.

Thursday afternoon's meeting will be executive session. In addition to an address by W. H. Blood, Jr., chairman of N. E. L. A. safety code committee, on the "National Safety Code" reports will be heard from the following committees: Engineering committee, G. E. Wendle, chairman; special committee, G. L. Smith, chairman, and committee on rates, Henry Harris, chairman.

On Friday morning the following papers will be read: "Testing of Current and Potential Transformers," by W. A. Fogler, Philadelphia Electric Company; "Boiler-Room Operations," by H. H. Wilson, Harrisburg Light & Power Company; "Hiring and Placing Men Under Standardized Working Conditions," by J. F. Martin and H. N. Müller, Duquesne Light Company; "Simplified Costs and Factors in Underground Distribution," by W. H. Keating and H. N. Müller, Duquesne Light Company. In the afternoon the program will be continued by a general session in the auditorium for the purpose of permitting a more extended discussion of papers and topics, and for reporting and commenting upon the work of the geographic sections.

ENTERTAINMENT FEATURES

Many entertainment features have been planned, including a golf tournament for the men and a bowling and shuffleboard tournament for ladies. Each evening immediately after dinner there will be motion pictures on the hotel lawn. A reception to President and Mrs. Pohe is planned for the evening of Sept. 5. The entertainment features of the other three evenings have been arranged as follows: Wednesday evening, café chantant on the beach lawn; Thursday evening, a vaudeville show at the exhibition hall and on Friday evening an informal musical, followed by dancing.

Convention of Iron and Steel Electrical Engineers

The tenth annual convention of the Association of Iron & Steel Electrical Engineers will be held at the Hotel La Salle, Chicago, from Sept. 18 to 22. Arrangements have been made to visit the power stations of the Commonwealth Edison Company on Tuesday afternoon, Sept. 19, and the following steel plants on Friday: Illinois Steel Company at Gary and South Chicago, American Sheet & Tin Plate Company at Gary, Wisconsin Steel Company at South Chicago and Inland Steel Company at Indiana Harbor. The annual banquet and ball will be held on Wednesday evening.

The technical program has been arranged as follows:

Monday afternoon—"The Value of Records to an Operating Engineer," by Ray S. Huey; "Cost versus Upkeep of Direct-Current Motors," by A. M. MacCutcheon.

Tuesday morning—"Central Station Power for Steel Mills," by the central station power committee of the association; "Design of Structures for Steel Mills," by Charles A. Randorf.

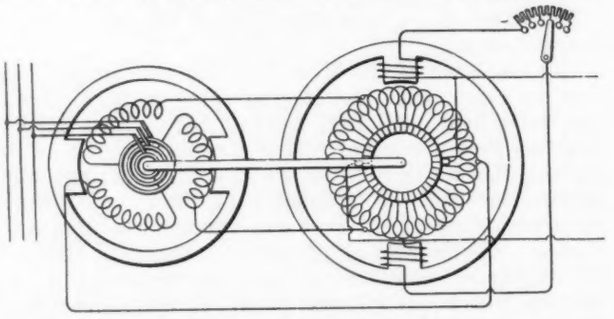
Wednesday—Joint session with American Institute of Electrical Engineers. Morning—"Underground Distribution Systems," by George J. Newton; "The Unaflow Engine," by W. Trinks. Afternoon—"Steel Conductors for Transmission Lines," by H. B. Dwight; "The Advantages of Modern Types of Direct-Current Machines," by David Hall.

Thursday morning—"Mechanical and Electrical Operation of the Heroult Electric Arc Furnace," by George W. Richardson; "Operating Characteristics of an Electric Reversing Blooming Mill," by E. S. Jefferies.

Thursday afternoon—"Control of Direct-Current and Alternating-Current Motors as Applied to Cranes," by Paul Caldwell; "Portable Electric Tools as Applied to the Iron and Steel Industry," by A. M. Andresen.

Self-Regulating Rotary Converter

In the usual rotary converter an ordinary reactance is connected in series with the alternating current mains in order that the direct current voltage may be varied. In Patent No. 1,194,138 to Joseph L. Burnham, a dynamo-electric machine is so arranged that it acts in effect as a reactance for the out-of-phase component of the current supplied to the converter, but has substantially no effect on the energy component of the current. The machine is coupled mechanically to the converter so that it may run synchronously. However, the field mem-



ROTARY CONVERTER DESIGNED TO BE SELF-REGULATING

ber has no magnetizing windings, and is preferably provided with polar projections which are placed so as to be in line with the component of the field corresponding to the wattless component of the current flowing through the windings. It will therefore be seen that the alternating-current supplied the rotary converter passes through the windings of the machine, and since these

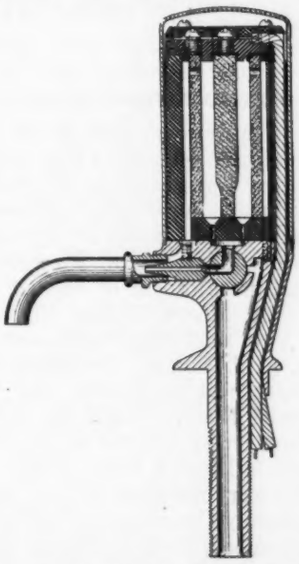
windings rotate at synchronous speed they produce a magnetic field by their armature reaction, which is stationary in space. The field varies in direction and magnitude with the lag or lead and the magnitude of the wattless component of the current flowing through the windings, and produces a voltage in the windings which is in line with that of the supply mains and either bucks or boosts it depending upon whether the current in these windings lags or leads the voltage. If the current is out of phase in the windings of the regulating member it produces a magnetic field which is so arranged that it is in line with the polar projections, otherwise the watt component of current magnetizes the frame body only through a path of very high reluctance.

N.E.L.A. Technical and Hydroelectric Committee Chairmen

The chairmen of the committees of the technical and hydroelectric section of the National Electric Light Association have been announced as follows: Overhead lines and inductive interference, H. B. Gear, Chicago; prime movers, J. M. Graves, Pittsburgh; electrical apparatus, G. L. Knight, Brooklyn; meters, C. H. Ingalls, Boston; underground construction and electrolysis, E. B. Meyer, Newark; power supply for electrification of steam railroads, Peter Junkersfeld, Chicago. The N.E.L.A. representatives of the national joint committee on overhead and underground line construction are: R. J. McClelland, New York; Thomas Sproule, Philadelphia; H. B. Gear, Chicago, and A. L. Snyder (alternate), Swissvale, Pa. The N.E.L.A. representatives on the American committee on electrolysis are: L. L. Elden, Boston; Philip Torchio, New York, and D. W. Roper, Chicago.

Electric Heated Water Faucet

A very compact form of water heater faucet is disclosed in patent No. 1,193,445, issued to Ernest C. Webster of East Oakland, Cal. The faucet is provided with a valve having an angular conduit making a right angle bend. By its means cold water can be led out of the



ELECTRIC WATER FAUCET HEATER

faucet or the cold water can be made to pass into an annularly arranged chamber having the walls of carbon heated electrically by means of a conduction current. After passing through the central annular chamber, the water emerges into an outer heat insulated chamber leading to the faucet outlet.

SOUTHERN ELECTRICAL MEN DISCUSS WIRING

North Carolina Electrical Institute Holds Two-Day Session at Raleigh Devoted to Inspection Topics and the National Electrical Code

Electrical inspectors of North Carolina held a two-day session in the House of Representatives at Raleigh on Aug. 9 and 10. This was the first meeting of the kind ever held in the state and was inaugurated by Insurance Commissioner J. R. Young. In calling the meeting to order Commissioner Young emphasized the importance of getting in close touch. He spoke of lighting methods from the dip to the present system of electricity and showed that with every step for better lighting there came increasing danger. Two important things to be done, he said, were to eliminate danger and conserve power.

He spoke of the benefits of comparing notes. If you have any difficulties ask the other fellow. He may tell you how he does it.

He confessed that he knew nothing about electricity or insulation but he said that it was his duty to inforce the laws. He spoke of the inspection being carried out by the department and said that he was going to give all the help possible—that he was not trying to create any distrust, nor was the department putting on any airs. He said that he was glad to say that he wanted their help and that he had their help.

After the commissioner had finished his introductory remarks, A. M. Schoen, electrical engineer, of Atlanta, made an address on "What Can Be Accomplished at This Meeting."

Some of the benefits he enumerated were the development of co-operation, the opportunity of discussing the code and the need of uniformity and arriving at uniform interpretation.

He interestingly traced the development of regulations in the electrical field. He spoke of the early condition when light was the only thing sought after and no thought was given to safety. He traced the evolution of the present code in general use throughout the country which was making for safety and efficiency. He showed the value of the code, the protection it gave to the contractor and the person for whom construction was done. If inspection is inforced the contractor knows what he is doing. And he said that he found that the contractor where he knew he was going to get a square deal was for inspection.

Inspection, he said, knocks out the tramp who goes through the country leaving a trail of dangerous work behind him.

General discussion followed the address of Mr. Schoen.

Among those who took part were John Fox, Paul Hullfish, W. E. Gehres, Raymond Hunt, R. J. Granthum, Capt. Sherwood Brockwell, and Chief Charles D. Farmer.

At the afternoon session, outside wiring was discussed, the discussion being led by Mr. Schoen. Next came a paper on inside wiring, by John Mangum, of Raleigh, city electrician and building inspector. This was followed by a paper on "Conduit Work," by A. L. Duckett, electrical inspector, Asheville. C. S. Whitaker, electrical inspector, Durham, then read a paper on "Electrical Wiring for 'Movies.' "

At 5 o'clock the members of the institute became the guests of the Carolina Power & Light Company, and, in automobiles, were taken to the substation of the power company at Method, the Raleigh steam plant, the Country Club and around the city. They were also shown, under the direction of Mr. Mangum, the wiring of the "movie" houses in Raleigh.

At the evening session the following program was carried out:

The Electrical Code of the National Board of Underwriters was discussed by Messrs. Schoen, Young and others. Papers were read as follows:

"What Good Wiring Means to the Property Owner and Occupant," by Capt. Sherwood Brockwell, fire prevention expert, Raleigh.

"Dangers From Outside Wiring," by A. M. Schoen, Atlanta.

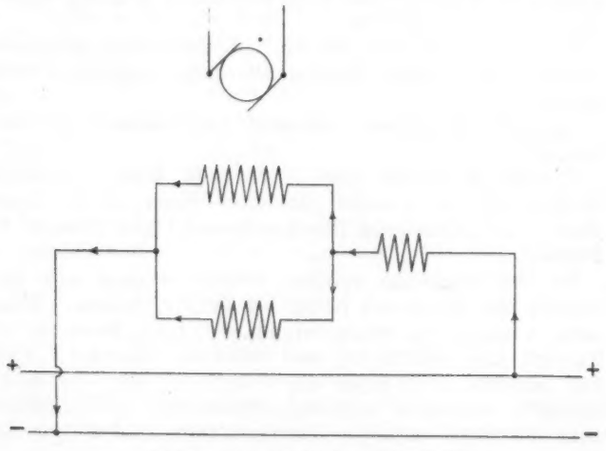
Inside Wiring

In discussing the subject of interior wiring John Mangum, city electrician said he spoke as a result of his observations in Raleigh where he found much to complain of. He warned against portable lamps and devices that are not properly wired, saying in this connection:

"See to it that no fans, or portable lamps are used in a building unless with reinforced cord which is attached to fixture by attachment plug. In lots of cases where portable lamps are used drop lights with cotton covered lamp cord have been extended over to beds so as to enable one to read in bed with the aid of the light. The cord is continually in use all over the house—for shaving, reading in bed, looking under the beds. If a person reading in bed should drop off to sleep this cotton covered lamp cord being old, the insulation partly off it, may arc together and cause a spark to drop on bed, which is liable to start a fire. These lamps are usually tied on the head of the bed with cotton covered string, which is liable to break at any time and the heat from the lamp, if it falls on the bed or any inflammable material, may cause it to catch fire. Therefore, reinforced cord and lamp guards should be used on portables of all sorts."

Field Excitation with Negligible Temperature Coefficient

An electrical circuit in which the field excitation is maintained constant at constant potential and independent of the temperature rise of the machine is made the subject of patent No. 1,193,076, by Ludwig Schon, assignor to the Fried Krupp Aktiengesellschaft, of Essen, Germany. The essentials of the circuit appear to be three field windings, two of which are in parallel and

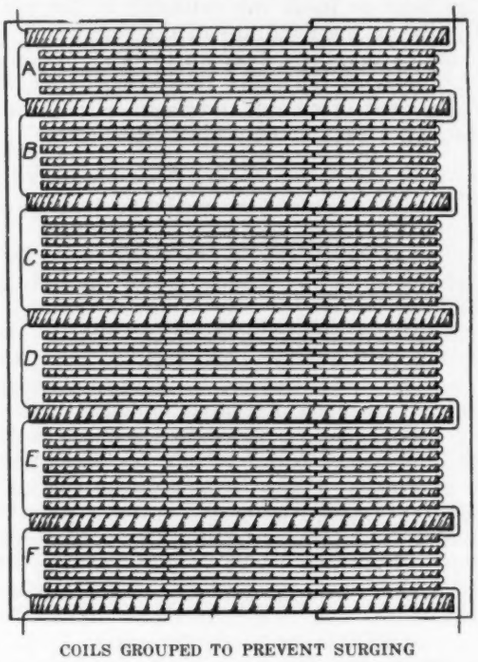


CIRCUIT FOR FIELD EXCITATION

in series with a third. A rather formidable algebraic calculation is incorporated in the specification, which is intended to indicate how the temperature coefficients are to be related to the resistance coefficients. A simplification is suggested by making the series winding of a constantan-like material.

Non-Surging Windings

C. P. Steinmetz, of the General Electric Company, in a patent No. 1,194,090, suggests an improvement over the Creighton invention whereby disastrous resonating voltages are prevented from being built up in electrical windings. In order to protect the windings the coils are assembled into groups as heretofore, but with unequal



COILS GROUPED TO PREVENT SURGING

numbers of coils per group instead of equal numbers of coils per group, as has been the common practice, and preferably each two adjacent groups are composed of different numbers of coils. This arrangement, whereby each two adjacent groups have materially different natural periods provides for damping or restraining by interference the oscillation of each group, whether the resonating frequency is produced therein or transmitted thereto over another group by a continued application of the frequency from outside the resonating group.

N. E. L. A. Accounting Committees

J. L. Bailey of Baltimore, chairman of the Accounting Section of the National Electric Light Association, has made the following appointments of chairmen of standing committees which have been indorsed by the executive committee: Classification of accounts, William Schmidt, Jr., Consolidated Gas, Electric Light & Power Company, Baltimore; form of annual report to commissions, George M. Moore, United Electric Light & Power Company, New York City; customers' records and billing methods, E. J. Fowler, Commonwealth Edison Company, Chicago; cost accounting and statistics, C. L. Campbell, United Electric Light & Water Company, Waterbury, Conn.; merchandise accounting, L. T. Coleman, United Electric Light & Power Company, New York City; stores inventory methods, W. E. Long, Philadelphia Electric Company; purchasing and storeroom accounting, K. C. Campbell, Detroit Edison Company; accounting efficiency, D. M. Speed, San Joaquin Light & Power Company, Fresno, Cal.; accounting education, Alex Holme, New York Edison Company; accounting service to small companies and monthly bulletin, Frederick Schmitt, New York Edison Company; commission accounting rulings, Edwin D. Dreyfus, West Penn Traction Company, Pittsburgh; membership, T. F. Wickham, Cincinnati Gas & Electric Company.

FIXATION OF NITROGEN AND WATER POWER

Presidents of the American Electrochemical Society Recommend Investigation of the Various Methods of Producing Nitrogen and the Development of Water Power

Inasmuch as the utilization of atmospheric or other sources of nitrogen to supplant Chilean nitrate in this country for the manufacture of explosives and as a source of fixed nitrogen for fertilizers, is in many respects an electrochemical problem, Committee on Public Relations of the American Electrochemical Society constituted of the president and past presidents of the society, has issued the following statements and recommendations:

1. We urge upon this government the necessity of providing at once eighteen months' supply, on a war basis, of Chilean nitrate, using government ships if necessary, this reserve to be stored at various strategic points.

2. Almost all of those who have intimate knowledge of the practical working of nitrogen processes are in one way or another associated with some particular process and we know of no experts who could be considered as having a strictly unbiased mind on the subject. As the government should be in possession of accurate confidential information regarding present developments in each of the processes proposed to date in order to be able to act wisely and promptly in case of sudden emergency, we add our endorsement to the recommendation already made by the Naval Consulting Board and others that a small committee of appointees by the President be delegated to visit each of those groups of men who control these processes and who have already intimated their willingness to furnish proper representatives of the government with full confidential data.

OPPOSED TO GOVERNMENT SUBSIDY

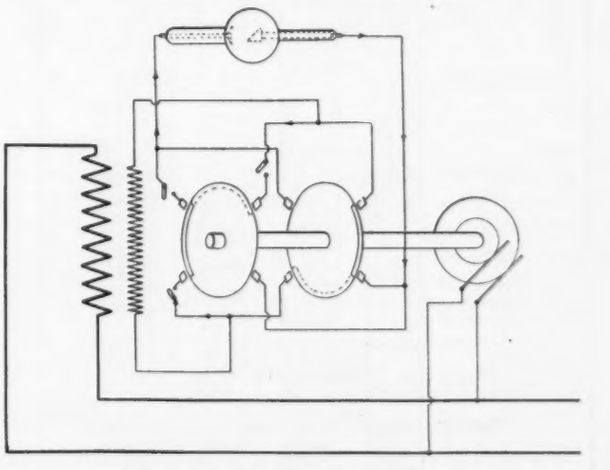
3. As we confidently hope that this country may never be involved in war, while thoroughly believing it should be prepared for immediate defense, it should be remembered that the great peace use of fixed nitrogen is as a plant food, and it is therefore desirable that private interests be allowed to develop the best and cheapest process on a peace basis without either government aid or government hindrance unless equally applied to all comers. We are therefore opposed to a government subsidy to any particular process at the present time or the immediate construction of a government plant working any particular process. All of the processes can apparently be greatly improved and the evolution of the best process will proceed more rapidly than under the artificial stimulation which government backing would give to any single process. The purchase of a suitable supply of Chilean nitrate and the possession of information upon which to base an emergency decision advocated above will serve the purpose of military expediency without discouraging private initiative. We are, however, in favor of a liberal water power policy as the question of the cost of power is vital to several of the processes. We believe it is in the highest degree conserving resources to make use of the otherwise wasting water power which can be conserved in no other way, and thereby preserving other sources of power, as coal, gas, and oil.

4. The processes to be considered may be classified into those which produce nitric acid by direct union of the nitrogen and oxygen of the air, such as the Birkeland-Eyde and the Pauling processes; those which produce ammonia by direct union of nitrogen and hydrogen, such as the Haber process; those which fix nitrogen in a complex compound such as the cyanamid process; and the action of nitrogen fixing bacteria in natural fertilization; and finally natural sources of fixed nitrogen, the only one of which is of sufficient magnitude to warrant consideration is by-product ammonia derived from the distillation of coal. All of these except the arc processes produce ammonia, and as this and not nitric acid is the chief desideratum for fertilizer purposes, there is not sufficient commercial incentive for the carrying of these ammonias of varying degree of purity through to the nitric acid required in the manufacture of explosives. All of the processes except that involving the use of bacteria have more or less active exponents in this country. We therefore urge that the research facilities of the government be concentrated upon these two points: The oxidation of ammonia and the *modus operandi* of nitrogen fixing bacteria. This could be done with the aid of some of the government departments. Thus the Bureau of Mines should be able to investigate the oxidation of ammonia while the fixation of nitrogen by bacteria might be well studied by the Bureau of Soils.

The statement is signed by Francis A. J. FitzGerald, E. C. Acheson, Lawrence Addicks, L. H. Baekeland, W. D. Bancroft, Charles F. Burgess, Henry S. Carhart, Carl Hering, F. A. Lidbury, William H. Walker, and W. R. Whitney.

Rectifier for X-Ray Work

Clarence E. Rohrer, in a patent, No. 1,194,071, states that it has heretofore been customary to select a small fraction of each wave, usually the crest of the wave of a given polarity of each and every cycle of an alternating, high potential current and to entirely discard all waves of the opposite polarity without rectifying any part of the alternating-current. By this means a very small percentage of the entire current is employed for useful purposes. The inventor proposes making the entire cycle available for X-ray purposes by rectifying selected wave cycles only so as to produce a spacing of the unidirectional current impulses. It is claimed that this spacing of the impulses produces better X-ray effects than when every cycle is rectified and appropriated. The elimination of certain of the periodic cycles from the tube contributes to prevent rapid accumulation of excessive heat which is transferred to the glass and liable to cause it to crack and break asunder and thus destroy the tube.



MACHINE FOR RECTIFICATION OF SELECTED WAVES FOR X-RAY PURPOSES

Efficient Employees Are an Element in Costs

Public Utilities Have Been Helped by the Co-operation of Their Working Forces Since the Beginning of the European War, Says S. J. Dill

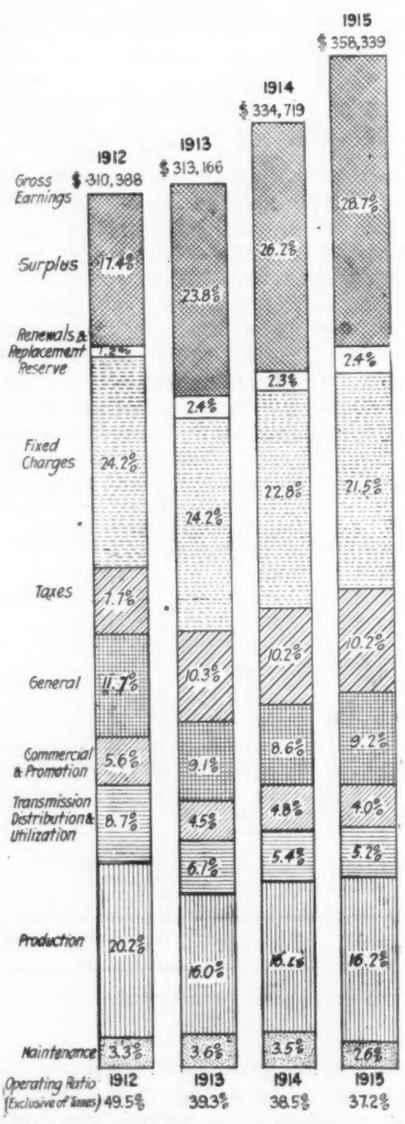
Efficiency of public utility service has been put to a severe test by the growing demands arising from the European war. S. J. Dill, vice-president of the United Gas & Electric Engineering Corporation, states to the Electrical World *that employees have co-operated loyally in the efforts to perfect the service. As this corporation supervises the operation of twenty-six utility properties serving 253 cities, villages and towns and earning $30,000,000 gross a year, the extent of its individual interest in economical production and careful conduct on the part of employees toward the public is apparent. If the value of efficiency in all of the departments could be calculated as a known percentage upon so large a volume of gross business the result would undoubtedly be a striking lesson. Efficiency is measured in physical accomplishment and also in the maintenance of wholesome public relations.*

Eleventh in a Series of "Talks in the Industry"

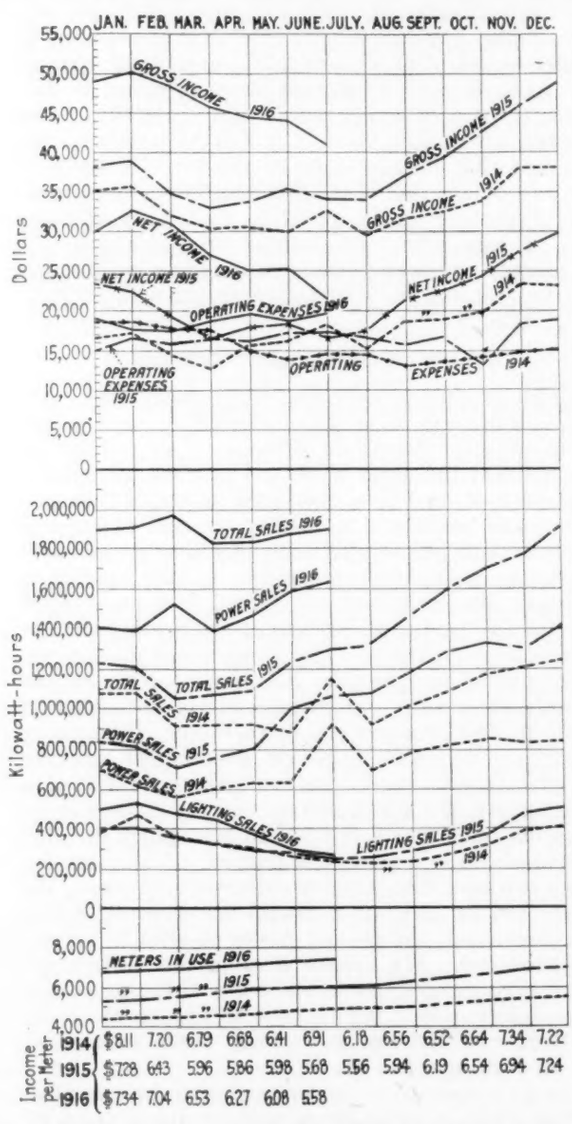
By Frederic Nicholas

"EFFICIENCY in the employee of a public utility company," said Mr. Dill, "consists of loyalty, co-operation and responsibility—loyalty to the company, co-operation in the aims of its management and a willingness to assume responsibility in his acts and his manner of treating the public.

"For ten years public utility companies of which I have knowledge have endeavored to increase the efficiency of their employees in all departments, because they realized that they must do so in order that the public might depend upon prompt and uninterrupted service. But the movement toward efficiency has re-



Charts Are Almost Indispensable in the Creation of the Necessary Feeling of Personal Responsibility and Efficiency



Efficiency Should Be as Clearly Defined for the Office and Executive Departments as for the Man Who Is Responsible for the Generation of Energy in the Power Station

ceived a new and strong impetus from the European war. Shortly after the beginning of the conflict abroad the managers of the utility companies throughout the United States decided that it would be necessary to use every effort to produce economy in the use of materials and increased efficiencies on the part of employees. Much anxiety was caused by the fear at that time that it would be difficult to obtain capital for improvements and extensions, as it was evident that the market for securities in Europe, upon which so many of these companies had relied, would be limited, if not entirely closed.

"Those who were in charge of the operations therefore conferred with employees in the several departments with the object of effecting economies and increasing efficiencies. It is gratifying to find that in general the employees, from that time to the present, have been responsive and very willing to give loyal support and co-operation. In consequence of this the public has received better service in many respects than it has ever had before.

Relative Efficiency High

"The relative efficiency of the average public utility employee ought to be and is much greater than that found in many other lines of industrial or commercial activity. One reason for this is that as the utility is the only source of the supply of electricity, gas or electric railway service in the community any defects which develop are observed immediately. Criticisms from customers are placed before employees, and we find that our men are usually very ready to act on suggestions for the betterment of the service.

"As a matter of fact the standing of the company in the community is usually based more upon the manner in which the employees treat the public than upon the precise quality of technical service which is rendered. It is therefore of the highest importance that deference and respect should be shown to the public at all times by all employees and that efficiency should be as clearly defined for the office and executive departments as for the man who is responsible for the generation of energy in the power station.

"Our experience shows that efficiency is steadily promoted by meetings of the managers and heads of departments of operating companies. Such meetings should be held weekly in order that all matters which improve operation and service may receive prompt attention. In their daily work many employees may note some deficiency in operation and if they are encouraged to report it to the head of their department they are usually willing to do so. Through this attitude on the part of the men and of those who are in direct daily contact with them the weekly meeting in the manager's office will frequently receive valuable suggestions.

Technical Journals in the Homes

"A practice which we have shown to be helpful is that of sending the technical journals to employees at their homes. I find that a more careful reading takes place in the home than when the journals are sent to the offices. Others in the household also become interested and call attention to articles which are of particular interest to the member of the family who is a worker in the utility company.

"Where holding companies have the control they contribute largely to the efficiency of the average public utility. The supervision of operation of a number of properties by one central company means the employment of specialized engineers and trained men in the general office, whose advice, assistance and broad experience are of constant value to managers and superintendents of the subsidiaries. Comparisons which the holding company is able to make between the results of various properties in different but comparable localities are a check and inspiration for local managers and do much to stimulate efficiency.

"I regard the bulletins which are now issued generally by holding companies and the large separate operating properties as instruments of much value in the promotion of efficiency and better service. It is evident that such bulletins are highly appreciated by employees and the comparisons and examples which they give do create a spirit of friendly rivalry and a desire for better efficiency which helps both men and and company.

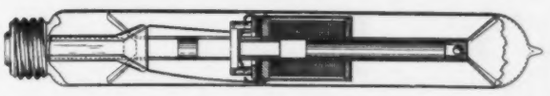
Personal Touch Promotes Efficiency

"My individual experience shows that the best means of promoting efficiency is the personal touch between the management and heads of the various departments and the employees. It is through such a personal connection that every individual will learn best to feel that the part which he takes in the operation of the company is important and that successful results require that he shall be on the job at all times.

"Charts are almost indispensable in the creation of this necessary feeling of personal responsibility and efficiency. These may show easily the efficiency of each department of operation as compared with a previous period and whether the efficiency is increasing or decreasing. Constant supervision and encouragement show the individual his part in the record, sustain his interest and lead him to feel that any improvement which he makes will be fully appreciated by his principals. Such a policy is a direct help to the heads of departments as well as to the firemen, meter-readers and other employees whose total work means so much to the ultimate position and strength of the company."

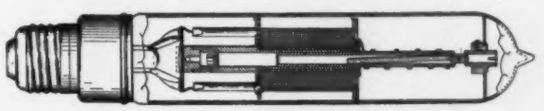
Overload Flicker Devices

A number of inventors have been engaged in devising flicker producing devices as a check for consumers disposed to exceed a current maximum over that called for by their flat rate. Thus, Samuel E. Doane, in Patent



PATENT NO. 1,194,281, S. E. DOANE, CIRCUIT-CONTROLLING DEVICE

No. 1,194,281, and William L. Kubach and Evan J. Edwards in Patent No. 1,194,194, provide analogous devices for the same end in view. In both cases a series electromagnet is employed, which on a given overload serves to attract an armature intermittently rupturing the circuit. To render the device conveniently insertable in an electric circuit, it is preferred to provide the



PATENT NO. 1,194,194, W. L. KUBACH AND E. J. EDWARDS, CIRCUIT-CONTROLLING DEVICE

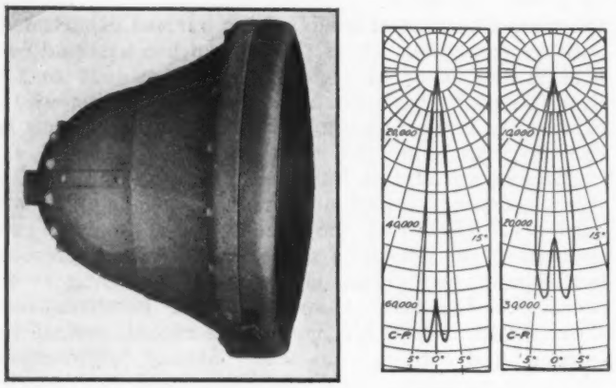
casing with the familiar screw case so that it can be inserted in the ordinary incandescent lamp socket. The armature on operation strikes a quick hammer blow opening the circuit, but various retarding means are employed, such as a dash pot with a ball valve, to control the closing of the same so as to cause a distinctive flicker.

Flood Lighting the World's Tallest Building

Equipment for Illuminating the 792-ft. Woolworth Tower, New York City, by 550 Projectors—Methods of Mounting Units—Control of Circuits by Automatic Dimmers

By H. H. Magdsick

THE Woolworth Tower in New York City was the first large structure to be displayed in its entirety by light from a permanent installation of concealed projectors with incandescent lamps. The system designed for the illumination of the exterior has now been in operation for a sufficient period to convince the management of the building that the form of lighting chosen was not alone a pleasing innovation with a strong initial appeal, but is also most satisfactory and valuable as a permanent means of advertising.



ONE OF THE FLOOD LAMP PROJECTORS, AND CURVES SHOWING DISTRIBUTION OF CANDLE-POWER IN BEAM

Architectural Features

The Woolworth Building is unique among the world's commercial structures both in its towering height and in the beauty of its Gothic lines. Buttresses, tourelles and a wealth of intricate detail supplement the vertical lines which form the main architectural feature. Touches of buff, green, red, blue and gold are combined with the cream surface of the glazed terra cotta with surpassing artistry. The Tower proper measures 86 ft. by 84 ft. at its base and rises 407 ft., or thirty-one stories, above the main building, and 792 ft., or sixty stories, above the pavement.

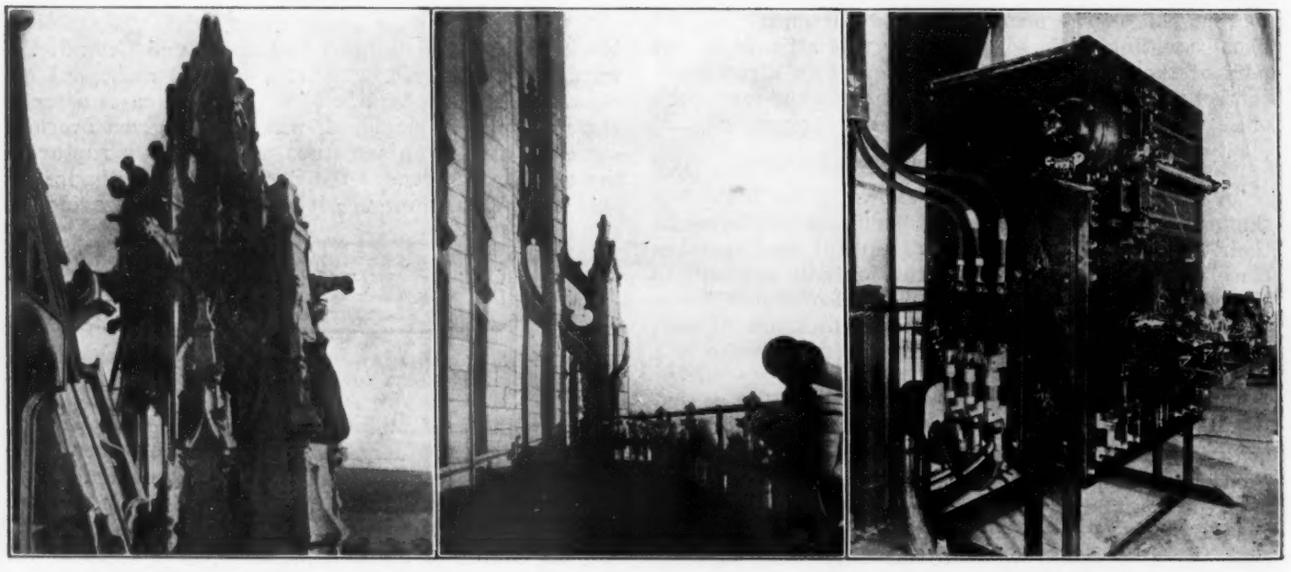
Reasons for Lighting the Tower

Although as the outstanding landmark of the city, the Tower by day shares attention with many other sights; at night its publicity potentialities were formerly largely lost in the darkness. It was realized, therefore, that if the structure could be displayed against the black sky in a manner in keeping with its dignity and beauty, it would form an invaluable advertisement for the building itself and the national institution for which the name "Woolworth" stands. The use of exposed light sources outlining certain parts had been attempted on special occasions but was found unsatisfactory. Among the several suggestions for a permanent lighting system, that made by the engineering department of the National Lamp Works was selected. This plan had for its object the flooding of the Tower with light from concealed sources in a manner which, while compelling attention, would preserve the detail of the surfaces in its natural appearance and not detract from the beauty of the structure.

Some of the Conditions to be Met

The solution of the Woolworth Tower problem was governed by several limitations. There was no satisfactory permanent equipment on the market and the limited time available made it necessary to make the specifications such that existing dies, tools or parts could be used. It was required to mount all projectors in a few restricted locations on the building itself. Some of these points were as much as 250 ft. from the surfaces toward which the light from the units were to be directed; in other locations the beams were required to graze surfaces only a few feet away.

Specular reflection from the glazed terra cotta further complicated the matter. From the night view of the completed installation it is apparent that for the illumination of most parts of the Tower it was neces-



METHOD OF MOUNTING THE PROJECTORS ON THE SPIRES AND GALLERIES—THE AUTOMATIC DIMMER EQUIPMENT

sary to direct the light from different angles in order to cover all surfaces. It was desired also to have the beams of several projectors on every part of the surface, so as to eliminate striations and minimize the effect of any outage of individual lamps. These conditions demanded a large number of projectors which should be adjustable as to spread of beam, light in weight, compact, readily installed, weatherproof, efficient and inexpensive.

THE PROJECTOR UNITS USED

A flood lamp unit employing a 250-watt concentrated-filament Mazda type C flood-lighting lamp was therefore designed. The usual practice where a concentrated beam is required has been to use a parabolic reflector with the lamp placed out of focus to obtain a greater spread. A unit of this kind could not give the desired range of adjustment or uniformity of beam for this application. Furthermore, an unmodified parabola would be inefficient, since with a lamp of this size the diameter would increase rapidly and limit the depth so greatly that the reflector would intercept but a small percentage of the total light from the lamp. For this installation the reflector was made spherical near the base so that the light source could be placed well back. In this manner a unit of short focal length, relatively deep, and therefore efficient, was obtained. The contour of the reflecting surface was laid out so as to secure the required range of distribution, as indicated in the curves accompanying the illustration of the lamp unit on the page opposite.

It was realized that a polished metal surface in a ventilated housing would not retain its efficiency in the salt atmosphere, where fumes from stacks were also present. Tests showed that repolishing or replating would be necessary at frequent intervals. A mirrored glass reflector was desired in order to secure both the highest efficiency and permanency, but it became necessary for the manufacturer to develop a new backing to withstand the high temperatures of a compact projector. This was successfully accomplished. Silvered metal reflectors were installed temporarily until the glass could be obtained, and their rapid deterioration soon proved the wisdom of providing the glass units. It will be noted that one-half of the total light flux generated by the lamp is secured within the zone 10 deg. on each side of the center. When the reflector is enclosed in the housing, 10 per cent of this flux is lost.

METHODS OF MOUNTING PROJECTORS

To the reflector is fastened a socket by means of a clamp strap, allowing the position of the lamp to be adjusted over the desired range. Spring clips attached to the housing engage the edge of the reflector and hold the socket, lamp, and reflector rigidly. The housing is of brass with hinged cover of special heat resisting glass. At the back is a bronze casting tapped to screw to a ½-in. conduit. The housing is amply ventilated. It is enameled to conform to the terra cotta surface of the building so that the few units not entirely concealed are rendered inconspicuous. The complete projector measures only 10½ in. in depth, its greatest diameter is 12 in. and its weight is about 7 lb.

Five hundred and fifty of these projectors are employed in lighting the Tower. They are so distributed as to secure an increasing intensity with each higher section, beginning with ¾-watt per square foot for the lower levels and increasing to four times this value. For lighting the first thirteen stories from the thirtieth to the forty-third floor, the units were mounted on the roof of the main building, or attached within a few feet of the Tower at this level at the front. For the higher sections, the projectors were directed upward from the balconies at the forty-third and forty-eighth floors, from the base of the mansard at the fifty-third, from the turelles and the observation balcony. It also became necessary to provide a few units directed downward from the forty-third floor balcony, until such time as a balcony can be placed at the base of the Tower on the front of the building. The projectors are self-contained and are supported by the conduit to which they are screwed. This feature greatly simplified the installation and allowed maximum flexibility in adjusting the direction of the beam by merely bending the conduit.

The main architectural features of the mansard extending from the fifty-third to fifty-seventh floors, the

THE SIXTY-STORY WOOLWORTH TOWER, NEW YORK CITY, AS IT APPEARS FLOODLIGHTED

observation balcony at the fifty-eighth, and the lantern structures from the fifty-ninth and sixtieth floors, are covered with gold leaf. By placing projectors properly, it was possible to obtain direct reflection from these surfaces at various angles and thus add life and sparkle to the spectacle. In this setting twelve 1000-watt lamps were placed within each of the two lanterns or crows' nests. The open panels were enclosed with a crystal diffusing glass known as "No. 12 Deflex," which transmits the maximum candle-power at angles near the perpendicular, with the result that the highest intensity of light is observed at great distances where the details of the structure would in any event be lost, while at a nearer view and lower angle, the intensity is reduced so as not to obliterate the setting.

Automatic Dimming Equipment

To hold attention and add variety without sacrificing dignity, it was decided to provide automatic dimming and special apparatus was designed for this purpose. By its use the intensity of the twenty-four 1000-watt lamps in the lanterns can be continually changed with a succession of peaks of varying intensity. The complete cycle was made sufficiently long to avoid the effect of regularity. At the point of lowest intensity, the lantern panels show a warm reddish glow no brighter than the adjacent gilded surfaces. At the maximum, they flare to a bright white light of fifty times this intensity. Forty resistance steps are provided, the first twenty of 3 volts each and the others of 1½ volts. The motor at the top of the panel drives a worm which carries the brushes over the contacts at a rate to cover the entire range of intensity in ten seconds. This motor is started, stopped and reversed by the timer located near the lower edge of the panel and driven at constant speed by the smaller motor. The variation in the candle-power of the lamps is altered as desired by changing the timer segments.

The difficult construction work involved in this installation was performed entirely by the electrical staff of the building under the direction of the chief engineer. More than 50,000 ft. of conduit of ½-in. to 3-in. diameter, 16,400 ft. of 500,000-c.m. cable and 50,000 ft. of No. 14 duplex wire were required. The magnitude of the undertaking is indicated by the fact that more light is employed for the illumination of this tower than is usually provided for the streets of a city of 25,000 inhabitants.

Experience with Electric Heating of Dwellings

Figures from Installation of Water and Oil Circulating Systems Tried at Seattle—The Outlook for Electric House Heating as an Off-Peak Load Where Cheap Waterpower Is Available

By J. D. Ross

Superintendent of Lighting, City of Seattle, Wash.

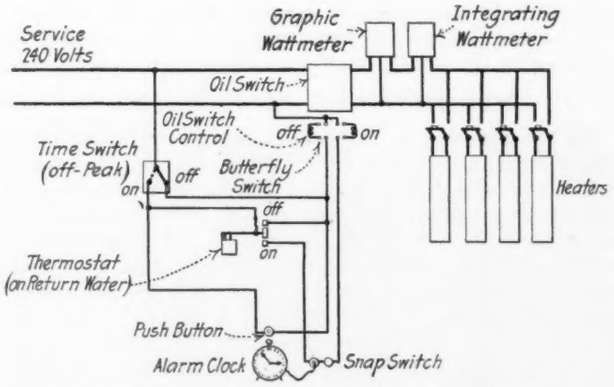
SEATTLE is surrounded by waterpowers which permit the economical generation of electrical energy. With a view to studying the possibility of the heating of dwellings by such low-price energy, the writer, about four years ago, began a series of experiments on electric heating of houses.

In order to make electric heating an off-peak load, some heat storage is necessary. Electric heaters adapt themselves to hot water, steam, hot-air, or direct heating, or to any combination of these methods. In order to test the possibilities of electric heat, experiments were made with almost every type.

Electric Heating as an Auxiliary to Coal

The first of these installations was in a cottage at 1119 Grand Avenue, Seattle, and included equipment totalling 6100 watts. Later, at 802 Thirty-third Avenue an electric water heater was installed to work in conjunction with the boiler of the hot-water heating system. In the coldest weather both electric and coal heaters were used while in mild weather the electric coil alone was used. This scheme of using electric heat with coal as an auxiliary has some advantage over the use of either alone. The electric heaters need be only half the capacity they would be to do the heating alone in the coldest weather. Since the load connected determines the rate for current, there is a considerable saving in the cost of electricity. At the same time little coal is required because the electric heaters alone are sufficient except in the coldest weather.

Another method, using electricity for auxiliary heating was tried at 530 Thirtieth Avenue South. This house had a hot water heating system. The radiators in the rooms most used were equipped with individual electric heaters placed in the basement directly under them, as shown on page 416. Each heater was connected so as to permit the water in its radiator to circulate through it, and at the same time the circulation from the coal-fired boiler was not interfered with. This method permits the automatic regulation of the temperature in each room by a thermostat working on its individual radiator. Only enough coal was used to keep the entire house at about 60 deg. Fahr., and each electric heater was used to bring its room to the temperature desired.



CIRCUITS FOR AUTOMATIC CONTROL OF HEATERS

The first heaters used here were simply coils wound around a section of the pipe, using the pipe for a short-circuited secondary and getting the heating effect from the hysteresis and eddy currents in the iron pipe. These heaters were inferior to the resistance type used later, since their power factor was low and it was next to impossible to eliminate the humming sound. This noise seems to be inseparable from the induction type heater. Although a type has been developed that is so well con-

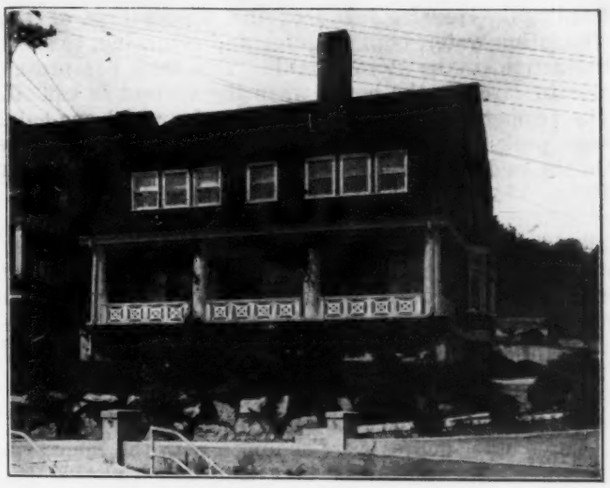
structed that the heater itself is noiseless, even this is apt to produce a noticeable hum when connected to a piping system.

Experiments using electricity as an auxiliary to ordinary furnace heat prove that electric heat is most convenient, but give little information on the economy of using electric heat alone. Data on this point has been gathered from four houses using electricity exclusively for heating. The first of these, the frame house on Thirty-seventh Avenue, was fully equipped with heaters, heat storage tanks, automatic heat control, recording wattmeters and all the apparatus that was needed for a complete test. There are nine rooms, four on the first floor and five above. The downstairs rooms were kept above 70 deg. Fahr. during the day and allowed to run down to 60 deg. during the night. The upstairs part was maintained at about 65 deg. during the day. Heat control was entirely automatic; thermostats were used to keep the temperature within 2 deg. Fahr. of the desired mark, and current was turned on in the morning by a time-switch so that the house would be warm before time to arise. The installation was made in February, 1914, and the house has been maintained at a comfortable temperature at all hours since with practically no attention. Characteristics of the house are as follows:

EXPOSED WALL SURFACE

First floor:	Exposed wall area	2,492 sq. ft.
	Window area	180 sq. ft.
	Cubic contents	10,475 cu. ft.
Second floor:	Exposed wall area	2,357 sq. ft.
	Window area	197 sq. ft.
	Cubic contents	12,275 cu. ft.

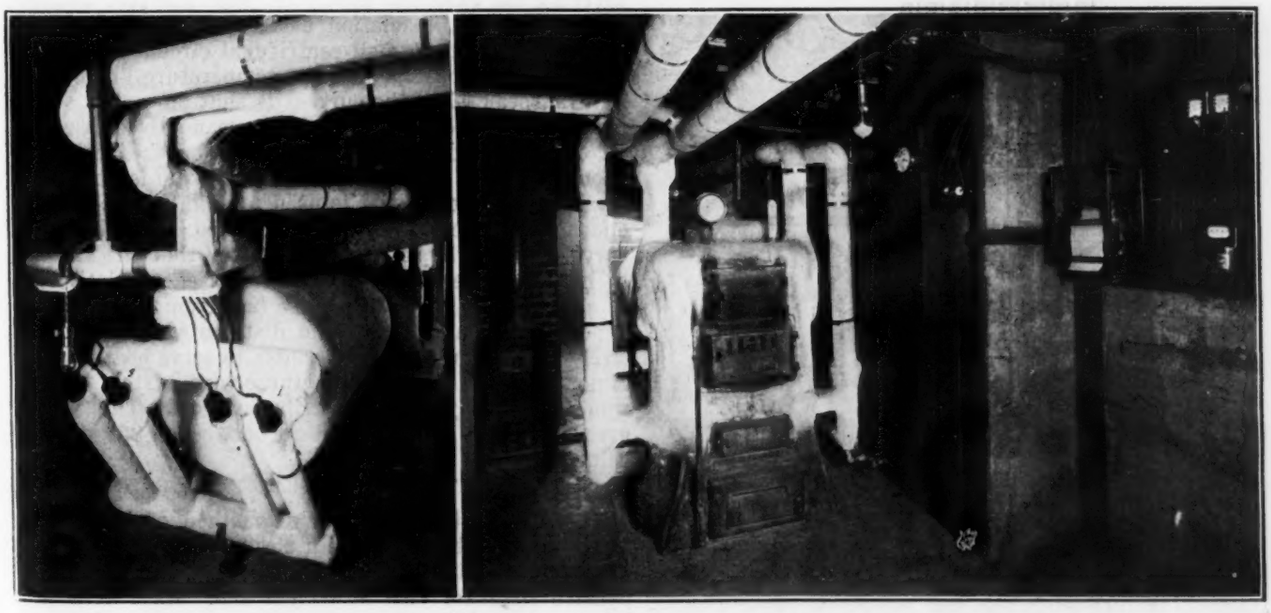
Floor surface is included in the wall area of the first floor to care for the unheated basement. Three-fourths of the ceiling is included in the wall area of the second floor. The house is of first-class construction. The hot-water heating system is of liberal design with a total of 690 sq. ft. of radiation. Four 10.5-kw. bayonet-type heaters were used, arranged with a storage tank of 500 gal. so that the water could circulate from the radiators through the heaters or through the storage tank. A time-switch was used to disconnect the circuit entirely during the hours of lighting peak, amounting to four and one-half hours in the winter months. Readings were taken daily for four months beginning with September, 1914, of the average, maximum and minimum air temperatures inside, upstairs and downstairs.



THE ELECTRIC-HEATED DWELLING ON THIRTY-SEVENTH AVENUE

TABLE I—AVERAGE TEMPERATURES AND MONTHLY ENERGY CONSUMPTION, ELECTRICALLY HEATED THIRTY-SEVENTH AVENUE DWELLING.

	Average Temperatures			Average Difference			Kw.-Hrs.	
	Outside	Upstairs	Downstairs	Minimum Outside	Upstairs	Downstairs	To Storage Tank	Total
April, 1914	47	66	70	34	19	23	...	1,928
May	53	67	70	39	14	17	...	968
June	54	67	70	39	13	16	...	534
July	60	..	..	45	..	..	...	79
August	59	..	..	44	..	..	...	260
September	53	67	71	42	14	18	677	3,015
October	51	66	70	39	15	19	...	2,950
November	42	66	70	29	24	28	...	6,357
December	36	66	70	20	30	34	4,001	9,651
January, 1915	37	66	70	24	29	33	...	8,068
February	40	66	70	25	26	30	...	5,728
March	45	66	70	30	21	25	...	4,290
April	49	67	70	33	18	21	...	3,018
May	51	67	71	40	16	20	...	2,954
June	55	..	72	42	..	17	...	1,976
July	60	..	..	48	..	..	...	284
August	63	..	..	50	..	..	...	103
September	54	67	70	41	13	16	...	1,517
October	50	66	71	40	16	21	...	4,244
November	40	66	72	28	26	32	...	8,223
December	37	65	72	20	28	35	...	9,075
January, 1916	27	64	70	10	37	43	...	14,046
February	38	65	72	22	27	34	...	10,990
March	40	66	72	28	26	32	...	8,500
April	45	66	72	34	21	27	...	6,480



THE FOUR 10.5-KW. BAYONET-TYPE ELECTRIC HEATERS, THE HOT-WATER TANK, AND THE MEASURING AND CONTROL EQUIPMENT

Readings were also taken of the temperature of the circulating water, both outgoing and returning, to show the action of the storage tank. This tank has proved able to care for the hours when the current is cut off. The temperature at the end of the four and one-half-hour peaks in December never dropped below 70 deg. On the coldest days the water in the tank dropped from 190 to 104 deg. during the peak, and the usual range of temperature during cold weather was from 170 or 180 deg. in the tank at the time the current was turned off to 110 deg. to 120 deg. at the time it was turned on again. Readings on temperatures have not been made regularly since the four months' test, but occasional checks show that the temperatures maintained inside the house are practically the same as during the test. Table I on page 415 shows the average temperatures and energy consumption by months.

Three other houses were equipped with the same system of electric hot-water heat, and data collected for periods covering approximately two years. Synopses showing the current used per year are given in Table II. Although the characteristics of the houses are omitted, the number of square feet of radiation, which was figured on the same basis as that in the Thirty-seventh Avenue house, is given in each case, and serves as a measure of the estimated heat requirements.

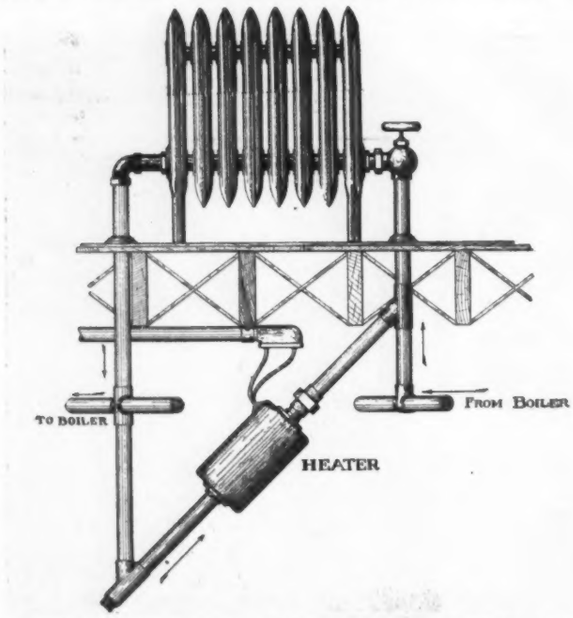
Table II—Electric Heating Results in Four Seattle Houses, Water Circulation System

	Address			
	225 37th North	1505 36th	615 Terry	802 33d
Number of rooms	9	9	.....	7
Kw. of heaters	42	32	12	10
Square feet radiation	690	640	328	350
Consumption, kw.-hrs., first year.	42,850	39,320	57,210	54,930
Consumption, kw.-hrs., second year	63,860	41,880	18,100*	23,990*
Average consumption, kw.-hrs.	53,355	40,600	.....	.....
Consumption per square foot of radiation per year	77.3	63.4	.....	.....

*Used as auxiliary only, during second year.

Results with Electrically-Heated Oil-Filled Radiators

During 1915 a number of heating installations were made with oil-filled, electric-heated radiators. These consist of an ordinary hot-water radiator filled with oil and having a cartridge-type heater inserted in the top. This scheme of heating has the advantage that each room has its own heater, and no piping is necessary. Results obtained with the oil radiators are practically the same in energy consumed and temperatures maintained as with the hot-water system, with the exception that there is very little storage of heat in the oil radiators to tide over the time when current is turned off. Data on two houses using the oil-filled system are given in Table III.



ADDITION OF INDIVIDUAL ELECTRIC HEATER WITHOUT INTERFERING WITH HOT-WATER HOUSE-HEATING SYSTEM

Table III—Electric Heating Results—Two Dwellings Using Oil-filled Radiators

	2541 11th Ave. W.	1238 E. Fir
Number of rooms	5	8
Kilowatt of heaters	10½	31½
Square feet of radiation	160	640
Duration of test	7 months	7 months
Consumption, kw.-hrs.	9,777	50 960
Estimate for one year, kw.-hrs.	16,000	85,000
Kw.-hrs. per square foot radiation	100	130

Sufficient data has now been collected to enable us to make a definite statement as to what can be done in any given case. However, so many variable factors enter into the heating of a home that each house must be studied and estimated by itself. The problems presented are almost entirely the same that have been met with regularly in heating and ventilating, except that here we have kilowatt-hours to deal with instead of the more familiar "B.t.u.'s." With electric heat the energy is, in general, several times as expensive as in the form of coal, so that every device for saving heat is valuable.

RADIATOR WITH ELECTRIC HEATING COIL

In the ordinary building with good ventilation the heat loss is about four-fifths through the walls, while one-fifth is used to heat the air. With improved heat insulation in buildings it is conceivable that half the heat now required may do the same work without in any way impairing ventilation, which requires about 30 cu. ft. of air per minute for each person. Any improvement tending to reduce the amount of heat necessary gives a corresponding advantage to electric heat.

The hot-water heating system with ample storage tank seems to present the most advantages for use with electric heaters. This is due to the fact that the heat storage keeps a uniform temperature, for less heat is required for comfort with steady than with intermittent heat. Considerable economy of heat is to be gained by covering the basement pipes, and especially the storage tank, with heat insulation at least 2 in. thick. The tank, fitted with a small centrifugal circulating pump, will keep the house at an even temperature during the lighting peak when the current is shut off.

Heating, however, cannot be permanently classed as an off-peak load. This is evident from the fact that about ten times the capacity of installation is necessary for heating a house that is used for lighting it. When one house in ten is electrically heated, then the load-curve valleys will be filled up. After that the success of heating by electricity will demand cheap electricity at all times, which is only to be had from water power generated in large units and distributed at comparatively high voltages. It is feasible to serve heating customers at 500 or 600 volts three-wire system, which would materially reduce distribution cost. This would give a voltage for the heating service of 250 or 300 volts.

Comparative Cost of Electric Heating

The comparative cost of this method of heating is fairly well established. With electricity at ½ cent per kilowatt-hour, it is from 25 to 50 per cent more expensive than for coal at $6 per ton. At 1 cent per kilowatt-hour, the electricity is two and one-half or

three times as costly. These figures are borne out by theory, which indicates that the 10,000 B.t.u. in a pound of coal cost 0.3 cent, while in the form of electrical energy, the 3413 B.t.u. in 1 kw.-hr. will cost ½ cent, making the current roughly five times as expensive. Then allowing for a furnace efficiency of 40 per cent, which is fair for the ordinary furnace, the current should prove twice as expensive. The showing of less than one and one-half times made in the experiments is probably due to more care in the use of the heat, so that less was wasted.

HEAT THE HOUSE ROOM BY ROOM AS NEEDED

A great deal can, however, be done in a home where care and economy are practised. On account of the difficulty of controlling a coal fire and the fact that a house is heated from one source, as in the case of a furnace, it is the general custom to heat every room whether it is necessary or not, it naturally follows that every room for a great part of the time is at the maximum temperature—about 72 deg. If the same system were followed out in the electric lighting of the house, the bills would be almost prohibitive. If the public can be educated to the point of heating the rooms to be occupied by means of a flexible system of electric heating—preferably one that brought the entire house to a temperature that kept the rooms dry and not uncomfortable for anyone passing through—while auxiliary heaters, separately regulated each room as desired, giving preferenec to those continually occupied—the cost would be very materially reduced below the above figures.

THE IMMEDIATE OPPORTUNITY FOR AN OFF-PEAK LOAD

From the standpoint of the central station, the off-peak load could be largely filled if 10 per cent of the homes on its lines used electric heating. There are probably that proportion of customers who are willing to pay the extra cost on account of the greater convenience, sanitation and cleanliness of electric heating.

Electric heating from steam power plants in the present state of the art is out of the question, excepting at very great cost. In the case of water power where the flow is made even by storage, the conditions somewhat approximate those for steam, in that each gallon of water may be used when desired and so represents a value. On the other hand, in the case of a water power using the minimum flow of a river, it would appear that electric heating would have its greatest application, this being particularly true where the maximum flow of the river comes during the late fall, winter and early spring, and is a minimum during the summer at the time when heating is least needed.

ELECTRIC HEATING ATTRACTIVE TO USERS

It is very noticeable that once electric heating is installed in the home, the occupants do not like to consider its removal. It delivers the home from the drudgery of building fires and handling coal and ashes, and banishes the disagreeable and injurious extremes of temperature so often tolerated with present means of heating by fuel.

It generates no poisonous gases and does not vitiate the air. It is, indeed, the ideal heat in everything save expense. These advantages are certain to overbalance the additional expense for the great class of people who demand the best and are willing to pay for it. While electric heat will probably never replace the more familiar forms entirely, there is no doubt that it is destined for a great development in localities having good water powers.

VOLTAGE RELATIONS IN NON-SYMMETRICAL LINES

Calculation of Voltage Variations in Phase and in Quadrature with Generating Voltage

BY R. C. POWELL
Member Engineering Staff, Pacific Gas & Electric Company, San Francisco, Cal.

In what follows the general case of a polyphase circuit of N parallel wires each carrying current will be considered. The voltage drop in any wire, as No. 1, is made up of three components, namely:

(a) The ohmic or resistance drop $= R_1 I_1$.

(b) The inductive drop due to the current in the wire itself, that is, the self-inductive drop, $= 2\pi f L_1 I_1$ where L_1 is the coefficient of self-induction of this wire alone, with no return.

(c) The inductive drop due to the currents in the other wires of the circuit; that is, the mutual-inductive drop. The mutual-inductive drop in wire No. 1 due to wire No. n is, $2\pi f M_{1n} I_n$, and the mutual inductive drop in No. 1 due to all wires is the vector sum, $2\pi f \sum_{n=2}^{n=N} M_{1n} I_n$.

The total inductive drop in wire No. 1 is then:

$$\text{Total inductive drop} = 2\pi f \left[L_1 I_1 + \sum_{n=2}^{n=N} M_{1n} I_n \right] \qquad (1)$$

For any polyphase system the vector sum of the currents in the several wires is zero, that is

$$I_1 + I_2 + I_3 + \cdots + I_n = O, \text{ or } I_1 = -\sum_{n=2}^{N} I_n, \qquad (2)$$

these equations being vector summations. Substitution of (2) in (1) gives

$$\text{Total inductive drop} = 2\pi f \sum_{n=2}^{n=N} (L_1 - M_{1n}) I_n \qquad (3)$$

But $(L_1 - M_{1n})$ is the total inductance per wire of the loop formed by wire No. 1 and wire No. n. (See article by E. B. Rosa in Bulletin of the Bureau of Standards, Vol. 4, No. 2.) The reactance per wire of this loop is $2\pi f (L_1 - M_{1n})$. The total inductive drop may then be written as the vector sum:

$$\text{Total inductive drop} = -(X_{12} I_1 + X_{13} I_2 + X_{14} I_3 + \cdots X_{1n} I_n) \qquad (4)$$

where X_{12} is the reactance per wire of the loop formed by wires No. 1 and No. 2, and so on for the other X's. Numerical values of these reactances may be taken directly from the usual tables giving reactances of parallel wires taking for the "size of wire" in the table the size of the wire in which the total inductive drop is be-

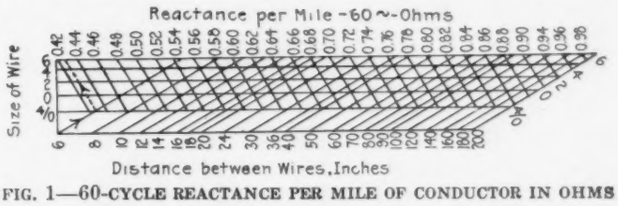


FIG. 1—60-CYCLE REACTANCE PER MILE OF CONDUCTOR IN OHMS

ing calculated. For convenience, Fig. 1 has been prepared to give 60-cycle reactances directly. Starting from the given distance between wires, follow the right-hand diagonal to the horizontal line of the given size, and thence along the left-hand diagonal to the reactance scale on the horizontal. For example, to find the reactance for 1 mile of No. 4/0 conductor with 6 in. spacing, follow the diagonal through 6 to the No. 4/0 horizontal, thence along the dotted diagonal, reading 0.428.

Let E_0 = the generated phase-voltage, that is, the voltage between the generator end of wire No. 1 and the generator neutral, E_1 = voltage between load end of wire No. 1 and the generator neutral and let R_1 = resistance of wire No. 1. Then the following vector equation gives the relation between E_0 and E_1:

$$E_1 = E_0 - R_1 I_1 + (X_{12} I_2 + X_{13} I_3 + \cdots I_{1n} I_n) \quad (5)$$

Note that the reactance volts as thus expressed are added vectorially to E_0, and may therefore be looked upon as a voltage rise. The rise due to each current is a vector leading that current by 90 deg. The vector

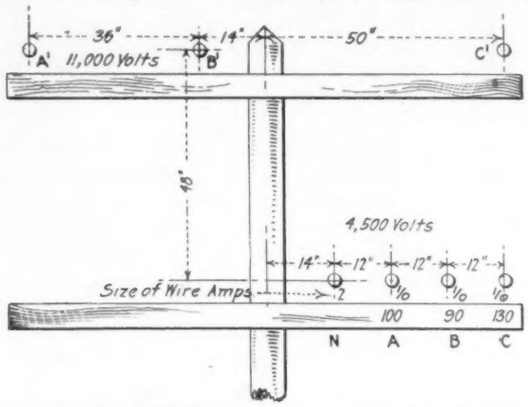


FIG. 2—ARRANGEMENT OF CONDUCTORS REFERRED TO

representing $(-R_1 I_1)$ which is in the opposite direction to I_1, may also be looked upon as a voltage rise. Equation (5) is then equivalent to the statement that E_1 is equal to E_0 plus the total voltage rise in wire No. 1.

Example.—Consider a 4500-volt, 60-cycle, four-wire, three-phase circuit on the same poles for 2 miles with an 11,000-volt, 60-cycle, three-wire, three-phase line. The arrangement is shown in Fig. 2. The power factor at the generator end of the 4500-volt circuit is assumed to be 100 per cent and that of the 11,000-volt circuit to be 90 per cent. There are no transpositions in either line. The currents in A', B' and C' are taken as 200 amp. each, and the currents in A, B and C are taken respectively as 100, 90 and 130 amp. The current vectors are then as shown in Fig. 3. The current vectors OA, OB and OC being in phase with the voltage to neutral at the generator end. It is to be noted that the vector ON, representing the current in the

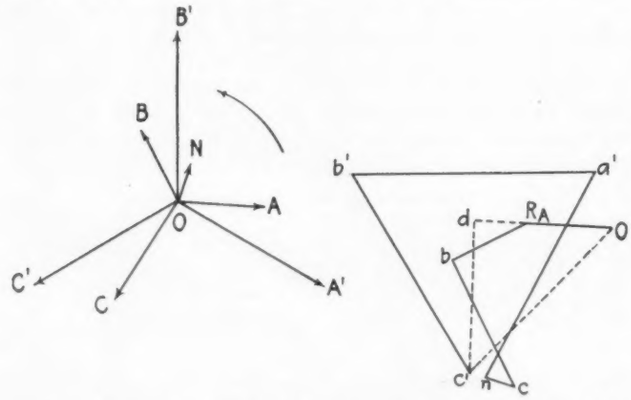


FIG. 3—CURRENT VECTORS FOR OPERATING CONDITIONS OF THE EXAMPLE. FIG. 4—VECTOR DIAGRAM FOR TOTAL VOLTAGE RISE IN WIRE "A" OF 4500-VOLT CIRCUIT OF FIG. 2

neutral, is equal in magnitude to the resultant of the current OA, OB and OC, but is displaced 180 deg. in phase from this resultant, that is, ON is equal and opposite to the resultant of OA, OB and OC. Fig. 4 is the vector diagram for the total voltage rise in wire A of the 4500-volt circuit. This diagram is constructed as follows: The resistance drop in 2 miles of No. 1/0 wire carrying 100 amp. is 104 volts in phase with the current; the corresponding voltage rise is in the opposite direction and is therefore laid off in the direction OR_A. The reactance volts for two miles of No. 1/0 wire at a distance of 12 in. from a parallel wire, when the current is 90 amp., is 100 volts. This is $R_A b$ in Fig. 4 laid off at an angle of 90 deg. ahead of OB (Fig. 3). The other vectors in Fig. 4 are laid off in a similar manner, giving O_C' as the resultant voltage rise in wire A. The voltage at the load between wire A and the neutral wire will be the resultant of the generated voltage between A and the neutral plus the voltage rise wire A, minus the voltage rise in the neutral wire. This is shown in Fig. 5. The generated voltages between wires and neutral are OE_{OA}, OE_{OB} and OE_{OC}, assumed equal and 120 deg. apart. The voltage rises are $E_{OA}E_A$, $OE_{OB}E_B$, $OE_{OC}E_C$ and ON in wires A, B, C and the neutral N respectively. Note that $E_{OA}E_A$ is equal to O_C' in Fig. 4. The voltages at the

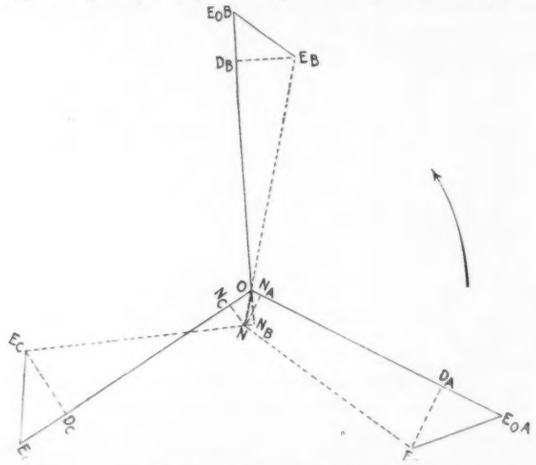


FIG. 5—COMPONENTS OF VOLTAGE AT LOAD END OF LINE

load end between the neutral wire and the wires A, B and C are NE_A, NE_B and NE_C, that is, these are the "phase voltages" at the load.

The voltage rises are usually small compared with the generated voltages, and a graphical solution for the load voltages is not convenient. This difficulty may be overcome by calculating the components of the voltage rises which are in phase and in quadrature with the corresponding generated voltage. Thus in Fig. 4, the voltage rise O_C' in wire A has the component Od parallel to the generated voltage between wire A and the neutral and the perpendicular component dc'. From diagrams similar to Fig. 4 the various components shown in Fig. 5 may be found.

The components to be used in obtaining NE_A are $E_{OA}D_A$, D_AE_A and ON_A and NN_A. In terms of these components and the generated voltage, the load voltage is,

$$NE_A = \sqrt{(OE_{OA} + E_{OA}D_A - ON_A)^2 + (D_AE_A - NN_A)^2}$$

with similar expressions for NE_B and NE_C.

For the problem under consideration the components are:

Wire	A	B	C
Voltage rise in wire in phase.....	—165	—50	—140
Voltage rise in wire lagging, 90 deg...	—185	—80	—196
Voltage rise in neutral in phase.....	+30	—100	+70
Voltage rise in neutral lagging, 90 deg.	—100	+25	+75

Then,

$$NE_A = \sqrt{(2600 - 165 - 30)^2 + (-185 + 100)^2} = 2405$$

$$NE_B = \sqrt{(2600 - 50 + 100)^2 + (-80 - 25)^2} = 2650$$

$$NE_C = \sqrt{(2600 - 140 - 70)^2 + (-196 - 75)^2} = 2400$$

The effects of voltage drop in the neutral and the mutual reactance of the various wires are thus seen to be quite appreciable, in this case actually raising the receiver voltage for phase B above that at the station.

Electricity in Chicago's Newest Family Hotel

Wiring Distribution by Vertical Riser Method—Electric Baking Equipment—Electric-Heated Tray Wagons for Serving Meals in Rooms—Motor Drive of Labor Saving Kitchen Machines

THE new Edgewater Beach Hotel on Sheridan Road and the Lake Front in Chicago's North Side fine residential district, has a very complete electrical equipment which shows how extensively the modern hostelry depends upon electric service. Except for the steam-driven house and service pumps, practically all other apparatus in the hotel is operated electrically, as shown in the accompanying table of equipment. Service is supplied by the Commonwealth Edison Company and is metered separately for power and lighting for the hotel and for the stores in connection.

In the kitchen, numerous labor saving devices, electrically driven, and an electric bake oven, have greatly facilitated the service rendered by this modern establishment. Throughout the building sockets and baseboard receptacles for the convenient attachment of electrical devices such as flat irons, curling irons, electric fans, vibrators, etc., have been provided that the guests may have every electrical convenience.

ELECTRICAL MOTOR EQUIPMENT

One 20-hp. slip ring motor belted to 10-ton CO_2 ice machine.
One 1½-hp. squirrel-cage motor belted to three-plunger drinking water pump.
Two ½-hp. squirrel-cage motors on ice crushers.
One ¾-hp. squirrel-cage motor on ice cuber.
One ½-hp. squirrel-cage motor for soda fountain.
One ½-hp. squirrel-cage motor on meat grinder.
One ⅛-hp. squirrel-cage motor on potato paring machine.
One ½-hp. squirrel-cage motor on dish washer.
One ⅛-hp. squirrel-cage motor on silver polisher.
Five 20-hp. elevator motors in pent house.
One 7½-hp. motor on bathroom ventilator.
One 10-hp. motor on kitchen ventilator.
All motors are threee-phase, 220-volt, 60 cycle.

The unusual shape of the hotel, that of an equilateral cross, lends itself well to an unusual wiring plan. Instead of following the ordinary horizontal distribution scheme with all the lamps in a room served through one fuse, vertical risers from the second to the eighth, or top floor, were installed and each carries one light, or in some instances two, in each room. Thus the blowing of any fuse cuts out only one light in any room instead of putting the entire room in darkness.

The governing consideration which led to the vertical-riser plan of distribution was that of economy, since it saved approximately one-fifth of the wiring and conduit required for horizontal distribution, and necessitated four cut-out cabinets for the eight typical floors as against thirty-two—one for each floor, each wing—for the horizontal distribution scheme. The ground floor, first floor and two wings of the second floor, are wired by the ordinary horizontal distribution system. Above these the floors are all duplicates of the plan arrangement, and the riser system is installed.

DETAILS OF WIRING ARRANGEMENTS

In the drawing of the wiring layout shown, owing to the fact that the two west wings of the first floor are laid off in rooms and hence are like the floors above, while the two east wings are given over to parlors, the wiring of the two west wings is typical and shows only the risers and leads over to the ceiling lights, while the east two wings show the conduit runs leading over to the bottom of the risers as well. Where two lights

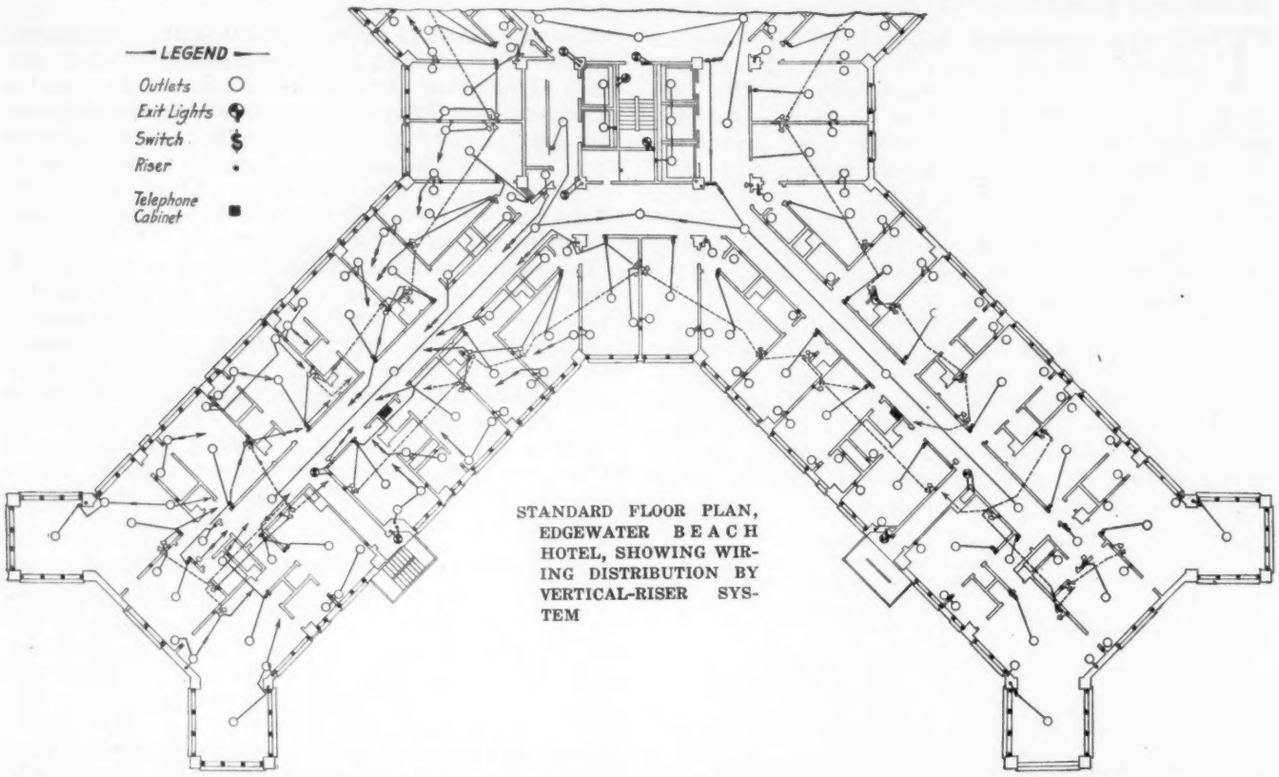
THE DINING ROOM, EDGEWATER BEACH HOTEL, CHICAGO. VARICOLORED GLOBES ARE USED IN THE CEILING FIXTURES

are on opposite sides of the same wall, outlet boxes are placed back to back with a close nipple between, making a simpler construction than cutting both boxes into the same two-circuit conduit.

The circuits are run with No. 10, 12 and 14 wire, depending on the length, and are laid out for not over sixteen lamps or 660 watts. The bathroom, writing desk, baseboard receptacles and ceiling lights are laid out for eight on a riser circuit, while the dresser lights are sixteen on a circuit. The ceiling lights might have been laid out for sixteen on a circuit, but there was no advantage in this, the length of ceiling wire more than offsetting the saving in riser wire.

Energy is served to four main cut-out cabinets, one in each wing on the second floor, from the switchboard in the boiler room, over 110/220 volt, three-wire feeders, and from these centers of distribution the risers distribute to the individual outlets. These four main cabinets contain 140 fuse plugs each, arranged in a double row on each side of the cabinet with the usual copper busbar connections. Harvey Hubbell type plugs and receptacles are used throughout the building.

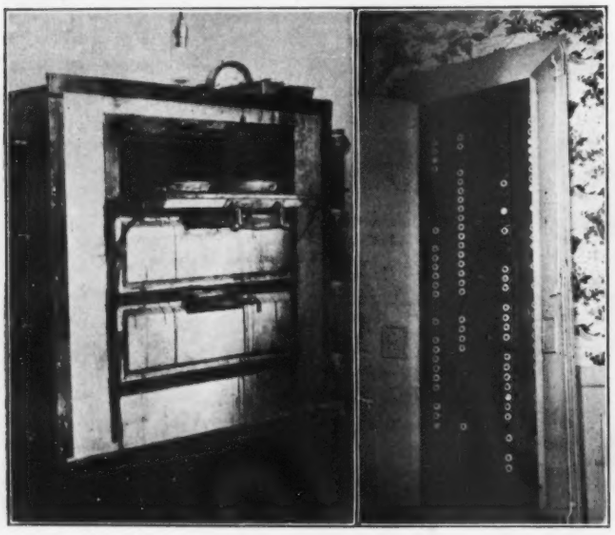
The Hughes electric oven installed in the kitchen for baking has been fitted with steam connections and a small amount of moisture is admitted when baking, in order to alleviate the baking of extremely hard crusts. All the baking for the hotel is thus electrically done.



STANDARD FLOOR PLAN, EDGEWATER BEACH HOTEL, SHOWING WIRING DISTRIBUTION BY VERTICAL-RISER SYSTEM

A novel feature of the electrical equipment of the hotel is the serving carts, or electric thermo serving tables used for private service in the rooms. There are small cabinets on all sides and the top of these carts, and on one end, they are electrically warmed, while the other half are iced for the cold drinks, sauces, etc. The hot foods are kept warm by connecting the cart to a baseboard receptacle when it is taken to the room. Invention of this device is credited to one of the hotel employees, August C. Trombley.

Marshall & Fox of Chicago, were the architects for the Edgewater Beach Hotel and the electrical work was done by the F. E. Newberry Electric Company, Chicago.



THE ELECTRIC OVEN AND ONE OF THE SWITCH CABINETS

SERVING WAGON WITH ELECTRICALLY-HEATED COMPARTMENTS

COMMERCIAL AND BUSINESS POLICY

A Department of Plans and Methods for Widening the Application of Electricity and for Extending Electric Service

"OPENING" A CENTRAL STATION SHOWROOM

Ceremonies Which Marked the Inauguration of the New "Daylight Corner" of the Merchants' Company at Indianapolis

From an exhibit room with one shallow show window to one that is "all show window" is a big step, but such a stride has just been taken by the Merchants' Heat & Light Company of Indianapolis, Ind. The new store is called the "Daylight Corner," and every effort has been exerted to make it live up to its name. The Daylight Corner came into existence with about 7000 people waiting to get a view of its interior. The spectacular opening was planned and executed in this way:

The company's sales department had known for about three months that it was to have a bright, new home. So the department staff made good use of that knowledge. On every hand the salesmen talked about the beautiful and alluring Daylight Corner. Women customers and prospective customers, too, were told about the pretty things that would be displayed, and about the flowers the company would give on opening night as souvenirs.

When the time for the opening was near at hand, a four-page "electrical" insert in the Indianapolis *Star*, issued co-operatively by the company and the firms who had helped furnish the store, clinched the whole story, and invited everyone to be present at the opening. A good-natured crowd of 7000 people showed up.

AN IMPRESSIVE MOMENT

Up until 8 p. m., the opening time set in advance, all the stores around the Daylight Corner were dark, then a bugle sounded, Old Glory, flood-lighted on its roof-top flagstaff, unfurled and floated in a breeze created by a battery of electric fans; the roof sign reading "Home Merchants' Heat & Light Company" flashed; all of the interior store and building lights blazed forth; the lintel sign at the first-floor level reading "Service First, Courtesy Always—Efficiency—Do It Electrically, Economy," was lighted, and a bank of fifty-one 250-watt projectors behind the lintel sign bathed the exterior of the building in soft light. The exclamations of astonishment of the assembled crowd gave audible testimony that the spectacular lighting effects had "registered," as the movie directors say.

While the many thousand lamps were bringing all parts of the building into prominence two cornetists on a balcony above the crowd played "The Star-Spangled Banner," and an orchestra in the store struck up some lively music. For two hours the crowd filed through the brilliantly lighted display room four and five abreast, receiving souvenirs—cigars for the men, flowers for the ladies, and post cards showing the flood-lighted Soldiers and Sailors Monument and an abridged history of Indiana for the children.

ARRANGEMENT OF SHOWROOM

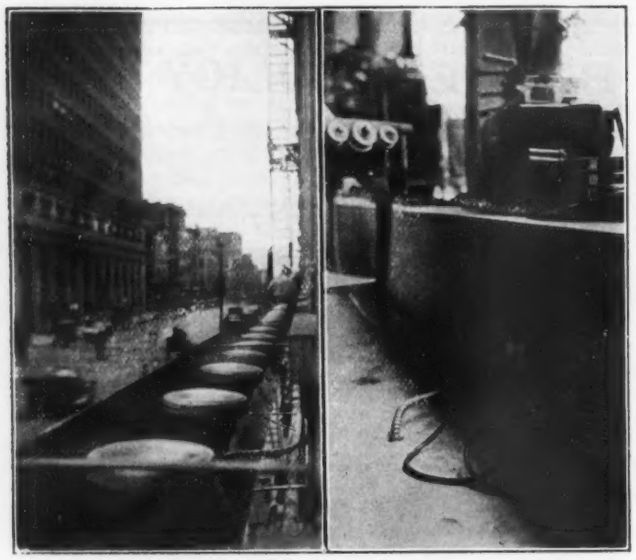
Practically the whole first floor of the new building is given over to the use of the company's customers. Ten huge plate-glass windows occupy the entire wall space for 90 ft. on one street and 25 ft. on another, and

AN ARRAY OF ATTRACTIVE APPLIANCES EXHIBITED BENEATH GLASS GREETS THE VISITOR AS HE STEPS INSIDE THE DOOR

extend within about 2 ft. of the floor. Behind them goods are shown on the low narrow window ledge and on tables low enough not to block the view of the room.

A caller in search of the sales manager does not need to ask, "Is the sales manager in?" On looking through one of the big glass windows the sales manager can be seen at his desk with only a low railing between the store and the open space that is his office.

A BUGLE SOUNDED; THE FLOODLIGHTED FLAG BURST INTO VIEW, FLUTTERING IN THE BREEZE CREATED BY A BATTERY OF ELECTRIC FANS, THE BUILDING LIGHTS FLASHED UP, AND AN ORCHESTRA LED OFF WITH A POPULAR AIR



LEFT—THE BATTERY OF 250-WATT FLOOD LAMPS WHICH LIGHT THE EXTERIOR. RIGHT—TWO OF THE MANY FLOOR AND WALL OUTLETS THAT SERVE THE MAIN SALESROOM

This practice of placing in the open the desks of the department heads who meet the public has been carried still further. Right in the appliance store—a little to the rear, so that a caller must pass all of the goods on display—are the flat-topped desks of the assistant sales manager, the information clerk, the electric-service salesman—who elsewhere might be known as an application clerk and might be placed behind a counter—and the head of the adjustment bureau.

The "Adjustment Bureau"

That adjustment bureau is something of which Sales Manager R. A. McGregor, who had the entire store planning in charge, is proud. While it used to be the style to have a complaint department, Mr. McGregor believes that the fad is passing. He believes that to direct the occasional dissatisfied customer to a place labeled "Complaint Department" is psychologically wrong. It leads the customer to believe that when he gets there he must register a large, healthy "kick." On the other hand, if he is directed to a desk marked with a sign "Adjustments," he immediately gets the impression that the function of the man behind that desk is to settle by fair adjustment whatever happens to be wrong. The sign, instead of inciting the customer to kick, will, it is believed, have the opposite effect.

This store will always be popularly known as the "Daylight Corner" because of its exterior lighting, but its interior lighting also helps to justify the name. Along the edges of the room above the ten plate-glass windows is a recess. In this recess, shielded from the street by several coats of black paint and a top coat of aluminum paint applied to the glass, and shielded from the interior by a projecting molding, are sixty 100-watt blue-glass daylight lamps on 1.5-ft. centers. Holophane reflectors direct the light to the working plane. The general lighting of the store is accomplished by five 400-watt lamps in semi-indirect fixtures.

Floor Outlets for Electrical Apparatus

As for wiring capacity, it has been aptly said that an industrial exposition could be staged in the room without adding to the existing circuits. In the basement a heavy lead runs the full length of the room just under the middle of the floor. Outlet boxes have been placed in this circuit at frequent intervals. The concrete floor is perforated in about 100 places and most of the holes are temporarily closed with brass plugs which can be removed and replaced at will with a large screwdriver. So when it is desired to connect a range or a motor or any large piece of equipment for service, a floor plug near the desired position is removed and a circuit housed in flexible conduit is run into the basement and there connected to the nearest outlet box. Many flush receptacles have also been placed in the window ledge so that small devices can be served without extra wiring.

A Drug Store with 3640 Watts in Electric Heating Units

In one drug store at Corpus Christi, Tex., all hot drinks are made with electricity. Chocolate is cooked on an electric hot plate rated at 880 watts, and is kept hot in an urn, such as is used by restaurants, to which has been attached a 660-watt immersion water heater. This heater is arranged in a manner which causes the water to circulate, bringing the three quarts of water, which is the content of the water jacket, from ordinary faucet temperature of around 60 deg., to the boiling point, about thirty minutes. The proprietor states that electricity in this case is cheaper than any fuel formerly used for this purpose.

This store has two radiators which take current through the same meter, and which together are rated at 2100 watts. One is of the luminous and the other of the radiant type. These are used without auxiliary means for heating the store. The following shows the energy consumption of this installation:

Month:	Kilowatt-hours
December	219
January	326
February	293
March	100

Boston Edison August Campaign on $15 Electric Ranges

During the month of August the Boston Edison Company is holding a special sale of electric ranges at $15. The range offered is portable, and is light enough to be lifted around by hand from the table to some out-of-the-way place when not in use, or can even be lifted from the table and set down on the floor beneath, completely out of the way. This Thermax range has two heating units with complete regulation for high, medium, and low temperatures. For a family of two, three, or even four, it will do all of the cooking and

SPECIAL AUGUST SALE
A NEW ELECTRIC RANGE
(Complete with Utensils for Cooking and Baking)
Clean, Cool, Simple, Handy, Cheap to Use
A $20 Range at
$15
$3 down
$2 a month
No Interest
Electric Wiring on Easy Payments
See This Big Bargain in Actual Use at Any of the Following Edison Light Stores:
THE EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON

A NEWSPAPER ADVERTISEMENT IN THE SALE OF $15 ELECTRIC RANGES BEING CONDUCTED BY THE EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON

baking. The range regularly sells for $20, but, during the month of August only, it is being sold at $15—$3 down and $2 a month, for six months, without interest charges. Persons who buy on the easy payment plan get the range just as cheaply as those who pay cash.

For these ranges a special wiring circuit which is inexpensive, is required. This is put in so that the housekeeper can have the advantage of the low cooking rate of a trifle over 2 cents per kilowatt-hour. The extra wiring will also be furnished the housekeeper on the easy-payment plan.

Conditionand Rates of Town Water Supply Pumping in Iowa

The accompanying compilation of data on thirty-seven city water supply pumping installations in Iowa has been prepared by a committee of the Iowa Section of the National Electric Light Association of which Edward Soukup of Cedar Rapids is chairman.

The present tendency to supply pumping service energy on a kilowatt-hour basis is well shown by the table. Of the thirty-seven rates referred to, twenty-seven are on a kilowatt-hour basis, seven involve a fixed charge per thousand gallons of water pumped, and three involve flat monthly charges for furnishing the service, independent of the quantity of water or electricity required.

Seven of these thirty-seven different stations have a capacity of 400 gal. per minute or more, and all of these seven are on a kilowatt-hour basis.

Wiring and Illumination

Latest Practice in the Electrical Contracting Field and in the Art of Interior and Exterior Illumination

Foresight in the Installation of Electric Heating Appliances

A recent installation of electric irons in a large summer hotel illustrates the importance of giving more study in some cases to the conditions of service. This hotel is provided with a complete electrically operated laundry, yet through careless arrangement of the irons and other equipment the fine results normally to be expected from electric service are only partly realized.

The chief difficulty in this installation arises from the fact that the cords of the irons are about 6 in. too short. This, of course, ought easily to be remedied, but the proprietors' interest is hard to arouse in anything so far removed from the front of the house as the power plant and auxiliary consumers of service. With the short cords the full sweeping motions necessary to carry the iron over the end of the ironing board in handling fancy dress goods are restricted; plugs are unduly pulled out of sockets, leading to occasional "shorts" in the outlets (always seemingly at rush periods) and the absence of ample cord length with an appropriate slack adjuster not seldom leads to the

DATA ON ELECTRIC WATER-SUPPLY PUMPING FOR THIRTY-SEVEN IOWA COMMUNITIES

Station No.	Pop.	Waterworks Ownership	No. of Pumps	Capacity		Aggregate Size, Hp.	Drive	Kind of System	Total Lift	Pressure, Pounds		Average Gallons per Month	Average Kilowatt-Hours per Month	Rates
				Gals. per Min.	No. of Motors					Normal	Fire			
1	550	Municipal	1	..	1	10	Belt	Standpipe	....	....	....	.....	125	6.5 cents, 5 cents and 4 cents per kilowatt-hour.
2	635	Private	1	150	1	10	Belt	Standpipe	116	40	....	280,000	.....	12.5 cents per 1000 gal.
3	742	Municipal	1	....	1	20	Gear	Pressure tank	....	40–60	....	.....	.....	4.5 cents per kilowatt-hour.
4	800	Private	1	150	1	10	Belt	Pressure tank	....	60	100	.....	Minimum 275	10 cents per kilowatt-hour.
5	846	Municipal	1	110	1	15	Gear	Standpipe	105	50	80	350,000	.....	9 cents per 1000 gal.
6	1,000	Municipal	1	120	1	10	Belt	Standpipe	102	50	50	.....	.....	6 cents kilowatt-hour.
7	1,300	Municipal	1	200	1	20	Belt	Standpipe	215	....	....	.....	1,000	4.5 cents kilowatt-hour.
8	1,350	Municipal	2	183	2	25	Gears	Standpipe	250	55	....	1,350,000	.....	8 cents per 1000 gal.
9	1,400	Municipal	1	300	1	15	Belt	Standpipe	135	55	....	.....	500	1st 625–8 cents; balance 5 cents per kilowatt-hour.
10	1,500	Private	1	425	1	50	Belt	Pressure tank	240	105	....	3,600,000	4,800	2.25 cents per kilowatt-hour.
11	1,500	Municipal	1	350	1	10	Belt	Pressure tank	70	24	100	1,500,000	.....	$65.00 per month flat.
12	1,500	Municipal	1	....	1	10	Belt	Standpipe	207	50	50	.....	.....	$65.00 per month flat.
13	1,500	Municipal	1	....	1	20	Belt	Standpipe	....	....	....	.....	.....	4.5 cents per kilowatt-hour.
14	1,500	Municipal	2	360	2	20	Belt	Standpipe	190	56	56	750,000	1,000	5.5 cents per kilowatt-hour.
15	1,538	Municipal	1	167	1	20	Gear	Standpipe	305	80–90	90	1,800,000	2,000	1st 1,000,000 gal.-9 cents; next 250,000-8 cents; balance 7 cents.
16	1,550	Municipal	1	150	1	15	Belt	Pressure tank	100	45	45	1,350,000	.....	$40.00 per month flat.
17	1,778	Municipal	2	177	2	15	Direct	Standpipe	....	62	62	1,200,000	.....	5 cents per 1000 gal. plus 60,000 gal. free
18	1,870	Municipal	3	....	2	25	Gears	Standpipe	350	35	35	2,700,000	.....	9.5 cents per 1000 gal.
19	2,000	Municipal	1	400	1	35	Chain	Standpipe	182	50	75	.....	5,300	4 cents per kilowatt-hour.
20	2,128	Municipal	2	1080	2	35	Belt	Standpipe	184	46	60	3,117,750	2,871	Average 5 cents per kilowatt-hour.
21	2,500	Municipal	2	70	1	20	Belt	Standpipe	408	....	....	2,250,000	4,100	Average 3 cents per kilowatt-hour.
22	2,680	Municipal	1	....	1	20	Belt	Standpipe	380	48	48	1,800,000	2,500	1st 450 per kilowatt-hours, 5 cents; balance 3 cents.
23	3,000	Municipal	2	200	2	50		Standpipe	....	40	120	.....	4,830	3 cents per kilowatt-hour.
24	3,300	Municipal	3	240	1	20	Belt	Pressure tank	340	60	60	4,000,000	5,000	2.25 cents per kilowatt-hour.
25	3,500	Municipal	3	120	3	80	2 B&D	Pressure tank	....	60	125	2,500,000	.....	3 cents per kilowatt-hour.
26	3,500	Municipal	4	500	4	130	Direct	Standpipe	325	50	60	4,000,000	11,000	2.75 cents average per kilowatt-hour.
27	3,780	Municipal	1	390	1	25	Belt	Standpipe	130	60	100	4,914,000	3,134	3 cents average per kilowatt-hour.
28	4,200	Municipal	1	390	1	25	Belt		270	110	110	6,500,000	.....	5 cents per 1000 gal.
29	4,663	Private	1	350	1	40	Gear	Direct pressure	....	60	120	.....	15,000	2.75 cents per kilowatt-hour, average.
30	5,000	Private	3	210	3	30	Belt	Standpipe	160	60	....	6,725,000	6,800	2.5 cents per kilowatt-hour.
31	5,000	Municipal	1	....	1	30	Belt	Tank	....	....	....	1,300,000	1,400	5.75 cents per 1000 gal.
32	5,400	Municipal	2	....	2	20	Belt	Standpipe	....	....	....	15,000,000	9,000	2.1 cents per kilowatt-hour, average.
33	8,000	Private	2	800	2	80	Gear	Standpipe	215	....	....	7,500,000	8,000	3 cents per kilowatt-hour.
24	18,000	Municipal	3	2400	3	165	Direct	Direct pressure	....	70	100	30,000,000	31,030	1.5 cents per kilowatt-hour.
35	33,000	Municipal	8	....	3	.....	Direct	Direct pressure	....	120	140	85,000,000 to 110,000,000	18,000	1.55 cents per kilowatt-hour, average.
36	34,000	Municipal	4	1800	4	220	Direct	Direct pressure	100	....	....	30,000,000	25,519	2 cents—1.5 cents per kilowatt-hour.
37	41,000	Municipal	4 electric	2000	4	380	Direct	Direct pressure	....	60	80	84,000,000	50,000	3 cents—1.33 cents per kilowatt-hour.

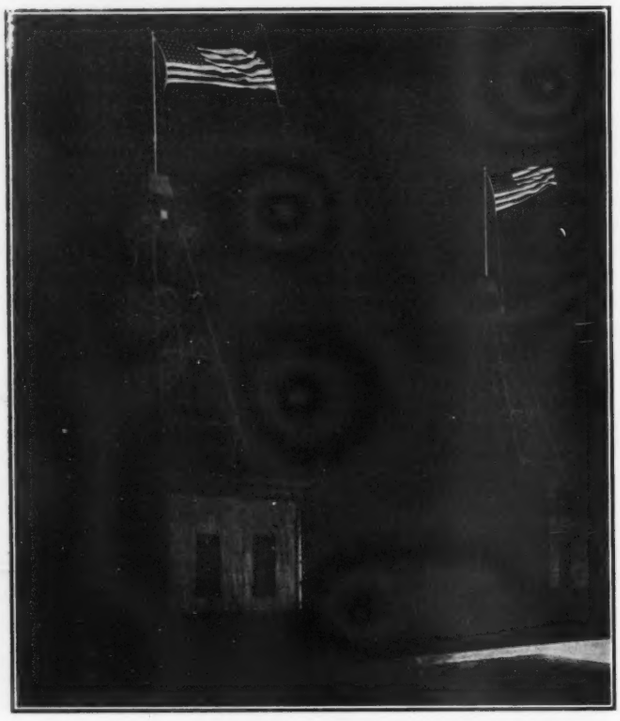
burning of cords on hot plates and further delay to important service.

Another defect in the installation is the failure to provide a separate fuse, pilot light and switch for each iron. Some irons are paired into outlets with resulting inflexibility of operation, inconvenience of service, and with undue consumption of energy.

A little more thought in laying out such installations helps both the purchaser and the contractor.

Flood-Lighting the Flag

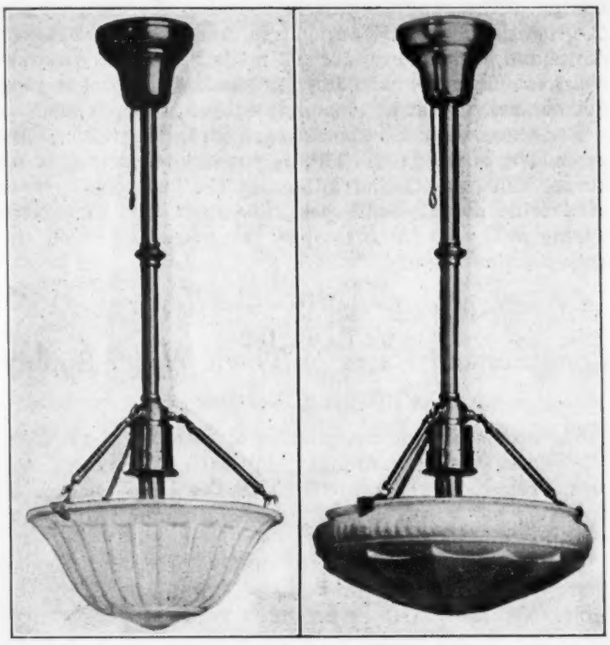
Two flags on the 201st Street generating station of the United Electric Light & Power Company, New York City, are flood-lighted nightly, and can be seen for several miles in each direction. Each flag is 15 ft. long and is illuminated by three 500-watt, Type C, concentrated filament lamps mounted in reflectors 120 ft. distant from the flag. Three reflectors are placed directly in front of each flag, two serving to illuminate the flag immediately in front, while the beam from the third lamp is turned across onto the other flag. The flags are first lighted at sunset and remain illuminated until midnight. Hundreds of people see these flags each night, and the favorable comments that have been received from civic and patriotic organizations indicate the large amount of interest shown by the public. These flags, which were first illuminated on July 4, will remain lighted until after Labor Day.



FIFTEEN-FOOT FLAGS, EACH LIGHTED BY THREE 500-WATT FLOOD LAMPS

Semi-Indirect Units for Store Lighting

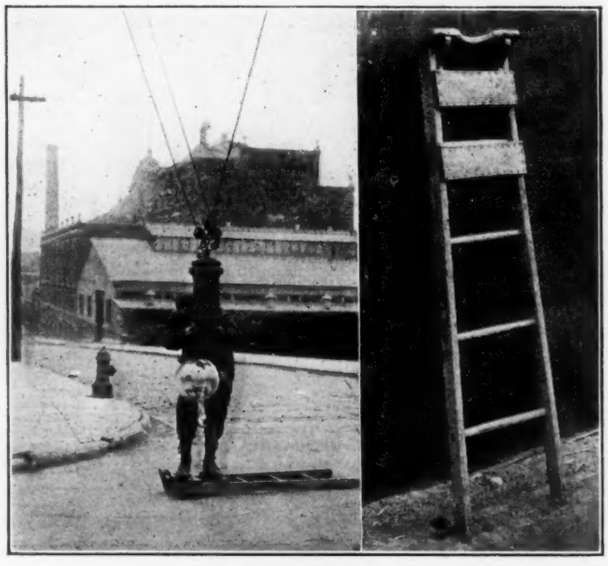
As a step in its plans for better industrial and store illumination the Commonwealth Edison Company of Chicago has just brought out two new styles of semi-indirect fixtures. These units, illustrated herewith, have pull-chain switches in the canopy, easily detachable bowl supports, and 3-ft. stems. The only difference between the two types employed lies in the 16-in. bowls, one type using a No. 200-S Sudan glass and the other a No. 200-M Monax glass.



SEMI-INDIRECT FIXTURES FOR STORE ILLUMINATION

These units are being offered to the company's customers on terms of $5 down and $1 a month with electric light bills for eleven months, making the total price $16. Fixtures with longer stems can be purchased at an additional cost of 70 cents per foot. For 25 cents a month additional, a customer can subscribe to the company's maintenance service which will provide cleaning at ten-day intervals. The lamp renewals are free, of course, except in the 100-watt and 200-watt gas filled units, for which a renewal charge of 25 cents is made. It is expected that these fixtures will find as much favor in stores as did the company's industrial units, which are now moving at the rate of over 1700 a month.

Combination Ladder Stool Used by Arc-Lamp Trimmers in Philadelphia

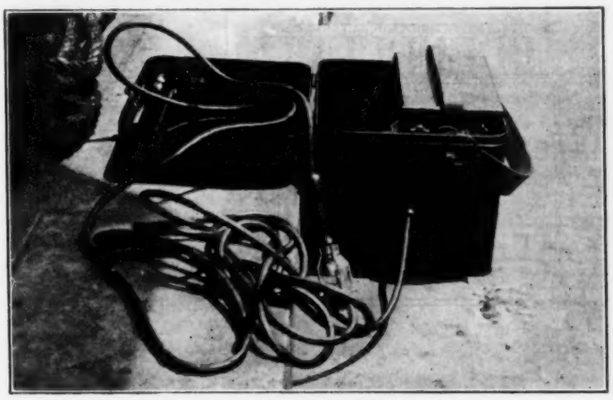


STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Storage Battery Lighting Set Used for Manhole Work

The Commonwealth Edison Company of Chicago has adopted as part of the standard equipment of its underground cable crews a small storage battery lighting outfit for use while splicing cable or doing other work in manholes. The object of the device is to eliminate the danger of taking an open flame into a manhole which may contain gas. This outfit is compactly contained in a standard 10-in. by 12-in. black-japanned pressed-steel battery box divided in the middle to provide



MANHOLE STORAGE BATTERY LIGHTING OUTFIT

one compartment for the battery and another for two 25-ft. lengths of cord with plugs, lamps and shields attached. The battery is a special Vesta 6-volt, 80-amp.-hr. unit, which is practically waterproof. In the end of the battery compartment, two Hubbell receptacles are inserted flush with the outside and are connected to the battery. To use a light the plug on the heavy reinforced stage cord is inserted and the battery box cover kept closed. A curved metal plate is clipped on one side of the lamp shield, and serves to shade the eyes of the cablemen when making a splice, and also to throw more of the light down on the joint where it is needed. The outfit weighs about 40 lb., and is carried by a leather strap.

The batteries are charged in any number from one to ten through a standard Vesta charging board supplied with 110-volt direct-current. Previous to making up these sets, the company used electric hand lanterns.

Construction and Laying of Special Concrete Ducts

According to the last report of the N.E.L.A. underground construction committee, the operation of about 10,000,000 ft. of concrete conduits or ducts for a number of years by one electric service company has shown that a burn-out in one duct has never been communicated to adjacent ones. The construction of these ducts is therefore of interest. The ducts are 5 ft. long, 3.5 in. in diameter (outside) and $\frac{5}{8}$ in. thick and are made of fine limestone screenings and Portland cement in proportions of 4.75 to 1 with just enough water to insure an initial set. The mold consists of two parts, the bottom being a semicircular sheet-steel shell and the top a steel casting. Before filling a 2.5 in. steel core is laid axially in the mold and supported on collars at each end. After the lower half has been heaped with concrete the top casting is clamped to the lower half of the mold and the entire unit removed to a conduit machine where a 3.5 in. revolving mandrel with a tapered end is used to force out the core, compress the concrete and furnish a smooth bore. The upper mold is then removed and the duct, supported in the lower half, is stacked on racks for one day to permit the initial set. After being sprinkled it is allowed to remain in the mold another day when it is removed and stacked on end in a storage yard for at least six weeks. During this time the ducts are sprinkled frequently enough to insure the proper setting of the concrete. After being thus seasoned each conduit is turned down concentric with the bore for 0.75 in. from each end. When the conduits are laid in trenches the adjacent ends are held together by sheet-iron bands fitting over the turned ends. A minimum of 1 in. of concrete is placed between ducts and the nest inclosed with a 3-in. concrete envelop, thus furnishing a monolithic mass and a 2.25-in. barrier between cables.

Charging Set Enables Line Crew's Electric Truck to Go Far Afield

A one-ton electric truck, which is used by the line crew of the Benton Harbor-St. Joseph (Mich.) Railway & Light Company, has been equipped with a motor-generator charging set. The company desired to use this truck for line work where its lines run into the country as well as in city construction, and adopted this method to make it possible to charge the truck at any transformer installation.

CHARGING SET INSTALLED ON ELECTRIC TRUCK FOR CHARGING ON COUNTRY TRIPS

The motor generator set is rated at 2 hp. 110 volts on the motor end, and at 40 amp., 80 volts on the generator end. The unit, together with the necessary starting and control equipment, is mounted in the frame of the truck just back of the driver's seat. It is covered except at times of inspection and forms a seat for some of the crew. The battery with which the truck is equipped, is a 40-cell Exide unit. The cost of equipping the truck with the charging set, including all labor and material items, was $135.

Convenient Methods and Devices for Sampling Coal

Several methods of securing coal samples for analysis were mentioned in the recent report of the N. E. L. A. committee on prime movers. One was to drive a 3 or 4-in. pipe vertically into the coal pile at several points,

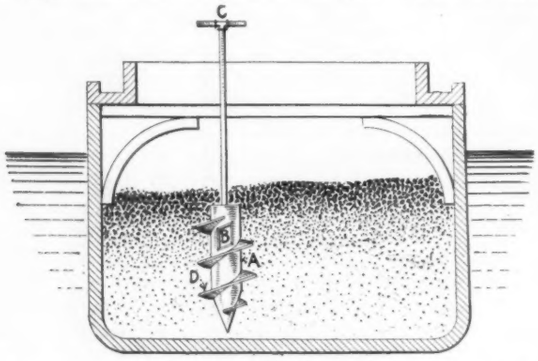


FIG. 1—DEVICE FOR OBTAINING COAL SAMPLE AT VARIOUS DEPTHS IN PILE

thus obtaining samples from the top to the bottom of the pile. Another scheme mentioned employs a device like that illustrated in Fig. 1. This consists of a cylindrical tube with a conical point and a gate, *B*, in one side that may be opened from the handle. The helical projection *D* on the tube permits screwing it into the coal pile until the gate is at the level where a sample is desired. Both of these processes have the disadvan-

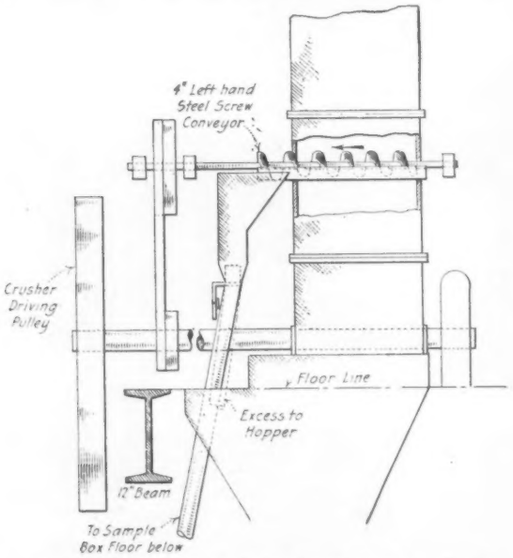


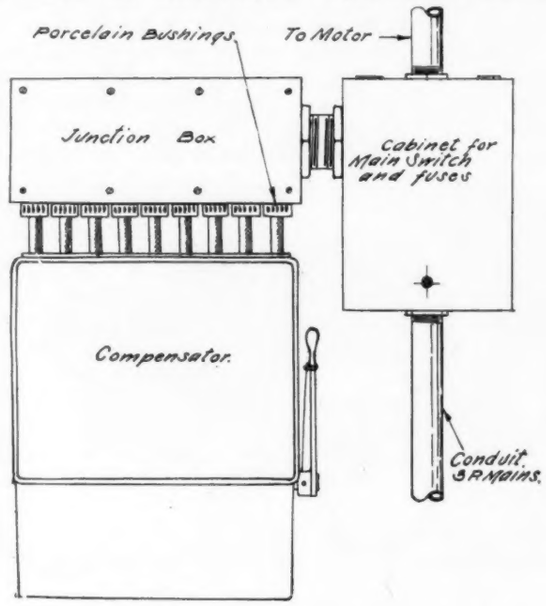
FIG. 2—CONTINUOUS AUTOMATIC COAL SAMPLER

tages, however, that they tend to reject large lumps of slate and pyrites. Another automatic sampler designed to overcome this disadvantage is shown in Fig. 2. It consists of a small screw conveyor installed transverse to the coal chute below the crusher and driven by the same source. Equipment similar to this is used in the generating station of the Remington Arms Works, Bridgeport, Conn. Coal gathered by the sampler may be mixed and further crushed and mixed as desired.

Use of Junction Box for Compensator Wiring

BY SAMUEL SPAGUOLA

Unless careful consideration is given to conduit systems in the wiring of polyphase induction motors that require compensators, the various terminals and half taps will present an unsightly and hazardous layout. The arrangement shown in the accompanying illustration meets the underwriters' requirements, and will



COMPACT AND SAFE WIRING FOR INDUCTION MOTOR COMPENSATOR

also be found suitable for indoor dustproof installation. All compensator leads are brought up into a junction box of standard gage through porcelain bushings. In this box all the necessary taps are made to the main switch. The leads are tapped ahead of fuses and motor terminals. This box can be placed on either side of the compensator or motor lead conduit.

In the event overload or no voltage relays are installed, leads from relays to the above protective apparatus can readily be placed in a conduit terminating in the junction box.

Measuring Energy in Unbalanced Circuits —Common Errors

BY G. W. TEFFEAU, JR.

Station operators and electricians often fail to recognize certain errors that are due to improper connections of alternating-current switchboard instruments. In the case of integrating watt-hour meters one frequently finds the current coils connected in series with the circuit operating the trip coils of an oil switch. The results from a meter so connected are very rarely correct, owing to the fact that the current transformer at the time of maximum current in the trip coils is being worked too high up on the characteristic curve. As is generally the case, the meters are tested when there is less than maximum current passing through the trip coils and when the meter adjustments are made for a load less than the maximum current.

One of the most common errors in meter connection is that caused by the use of one ammeter for economy's sake on two-phase or three-phase systems. It is very evident that a correct reading cannot be obtained with one ammeter, because on a commercial circuit, no matter how much care is exercised, a true balance cannot be maintained. It is far better to use two ammeters from which the current in the third phase of a three-phase system can be calculated.

A practice that has become general is to install one ammeter and to check periodically the other legs of the circuit with a line ammeter, transferring the transformers on the circuit to establish a near balance. Where one ammeter is used, it is customary to install an indicating wattmeter, and when such is the case the connections made are often as shown in Fig. 1. It will

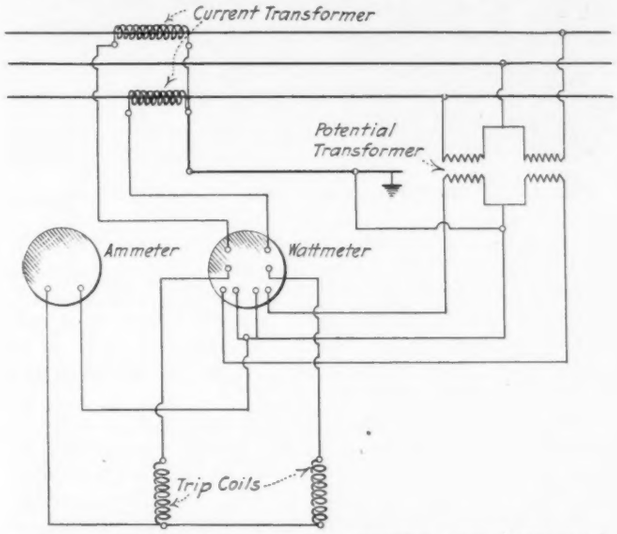


FIG. 1—CONNECTIONS OF ONE AMMETER AND INDICATING WATTMETER TO MEASURE THREE-PHASE POWER

be noticed that the ammeter will indicate the average of the sum of the currents in two legs. This is satisfactory so long as a balanced condition is maintained, but whenever the currents in the two legs containing the current transformers are unequal, the indications of the ammeter are liable to vary decidedly. Not only will an unbalanced condition of the circuit affect the ammeter, but grounds and high voltage leakage have an effect. With the connections as shown in Fig. 1 the indications in Table I were obtained from the same circuit over a period of six hours. The circuit was supplying a mixed load of light and power, and was practically balanced during the peak hours.

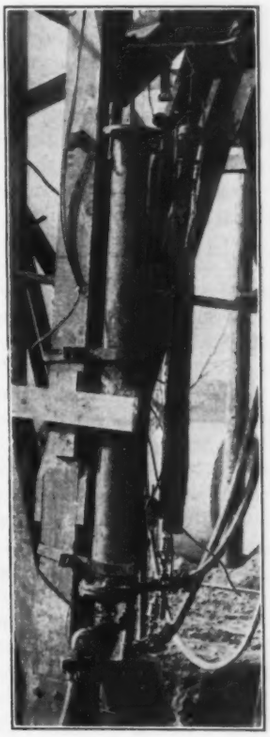
TABLE I—READINGS WITH CONNECTIONS OF FIG. 1 OVER PERIOD OF SIX HOURS

Reading in Kw. of Indicating Wattmeter	Amperes	Volts
240	75	116 × 20 = 2320
300	70	117 × 20 = 2340
340	80	118 × 20 = 2360
390	65	120 × 20 = 2400
400	175	125 × 20 = 2500
450	126	129 × 20 = 2580

Too much stress cannot be laid on the equipping of circuits for unbalanced conditions. For economical operation it is essential that the true power factor be known at all times. This can be readily obtained by the use of two ammeters and a wattmeter in the same circuit. The readings of the two ammeters should be added directly, multiplying this sum by the decimal 0.866, then multiplying this product by the voltage of the circuit and dividing by 1000. This result, when divided into the true watts as indicated by the indicating wattmeter, will give the power factor.

Use of an Electric Reheater on Compressed Air Line

The accompanying illustration shows the electric heating element of a reheater used on a compressed air line as constructed and employed by the Utah Power & Light Company on an air line which operated pile driving hammers. The heater as constructed was designed to raise the temperature of 400 cu. ft. of air per minute 75 deg. Fahr. The outside casing for the heating element is a 6-in. pipe 6 ft. long fitted with flanged unions for reducing to a 1.5-in. pipe. The air enters the lower end of this casing, as shown in the illustration, and circulates around and through a 3-in. pipe 5.5 ft. long suspended inside the 6-in. pipe by means of bracket braces bolted and riveted to the latter.



HEATING ELEMENT AND CASING OF 7.5-KW. AIR REHEATER

The inside 3-in. pipe is wrapped with five 1500-watt General Electric electric oven elements which are wired with heavily-tinned copper wire that will stand high temperatures. The elements are connected so that two, three or five units can be used as needed. The terminals used to bring the feeders to the outer pipe and prevent air leaks at 100 lb. pressure are Bosch automobile spark plugs. The heater terminals and feeders are brazed to the center post of the plugs.

This reheater has been in satisfactory operation some time and its cost of operation has been about $1 per day. To do the same work would have required a steam outfit and boiler which would burn about one-half ton of coal per day. The cost of operation for the steam outfit, including attendance, was placed at $5 per day. While the exact temperature of the air at the hammer is not known, it is estimated that it is about 125 deg. Fahr. The operation of the reheater has eliminated trouble from moisture and low temperature in the operation of the hammers. The outfit was designed and constructed under the direction of W. E. Roche of Gibbons Brothers, Reed & Roche, contractors, and constructed by the Utah Power & Light Company.

Selection of Fan and Motor Speeds and Method of Connecting Apparatus Mechanically

BY T. W. REYNOLDS

The maximum peripheral velocity of fan wheels should not exceed 3600 lineal feet per minute. Since objectionable conditions may arise when the air passageway between a fan and the first duct outlet is short, say 50 ft. or less, it may be necessary to limit the peripheral velocity still more, whereas under converse conditions a velocity of 4000 ft. per minute may be permitted. Furthermore, the air velocity through the fan-discharge outlet should not exceed 1800 lineal feet per minute, and the variation from this rate across the duct cross-section should not be more than 20 per cent. Vibration of fan

blades due to cutting the air may be reduced by curving the ends slightly backward, but this decreases the fan efficiency slightly. This modification is permissible, however, when the distance between the fan and the nearest duct outlet is less than 50 ft.

Unless motors with an unusually large number of poles are used, a construction which makes them relatively expensive, alternating-current motors will not operate at speeds as low as the economical speed of fans. For this reason speed-reducing transmissions, such as belts, silent-chain drive and the like, are usually required, the latter especially where the distance between the motor and fan is small. Silent-chain drives are not advisable, however, where they must be installed in passageways through which the air is forced, especially if the discharge path is less than 100 ft.

Direct-connected motors eliminate the noise and upkeep of speed-reducing transmissions, and are sometimes imperative where only limited space is available, but owing to the low-speed motors required are relatively expensive. While the operation of steam engine-driven fans permits direct connection of units and the utilization of exhaust steam in the air-heating coils or in a heating system, it involves the use of a boiler which must be capable of operating occasionally at higher than the average pressure, reducing valves, low and high pressure piping, boiler-feed pumps, grease extractors, steam separators, etc., and in many cities the supervision of a licensed engineer. On the other hand the initial investment and operating and maintenance expenses are considerably lower with motor-driven fans, especially where energy can be purchased at a fairly low rate. When an electric generating plant is employed where the fan equipment is required or where the fan must be placed in an attic or penthouse, it is always preferable to use motor drive.

Motor Drives in a Wood Heel Factory

By Thomas D. Bond

The recently completed wood heel factory of the Sanders-Wason Company at Haverhill, Mass., operates more than 100 hp. in motors in the production of 60,000 pairs of wood heels per day. The raw material is delivered in the form of maple planks which are first planed and then split lengthwise by a large band saw driven by a 10-hp. motor. The sticks thus made are cut into blocks by a circular saw driven by a 3-hp. motor. These blocks are then grooved and delivered to special turning machines. These devices are each operated by a 3-hp. motor, driving knives at 5000 r.p.m. The turned heel is next concaved to fit the shoe on a special machine driven in conjunction with others by a 7.5-hp. motor. The finishing processes, such as scouring, trimming and buffing are performed on motor-operated machines. The waste chips and shavings from the processes are removed by a 70-in. Buffalo Forge suction blower to which all machines are connected by a system of piping. Each outlet has its own shut-off to save power. The blower is located in the basement and driven by a 15-hp. motor.

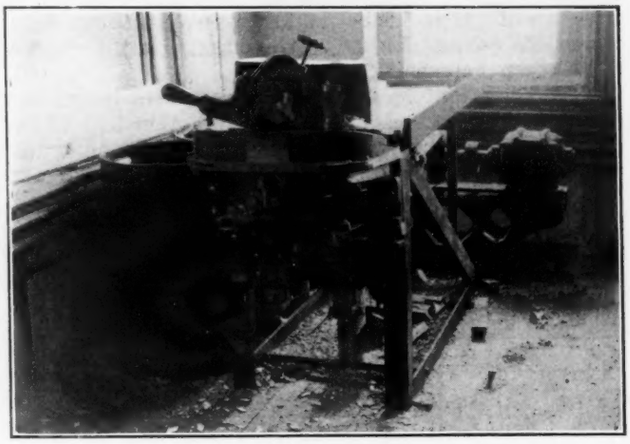
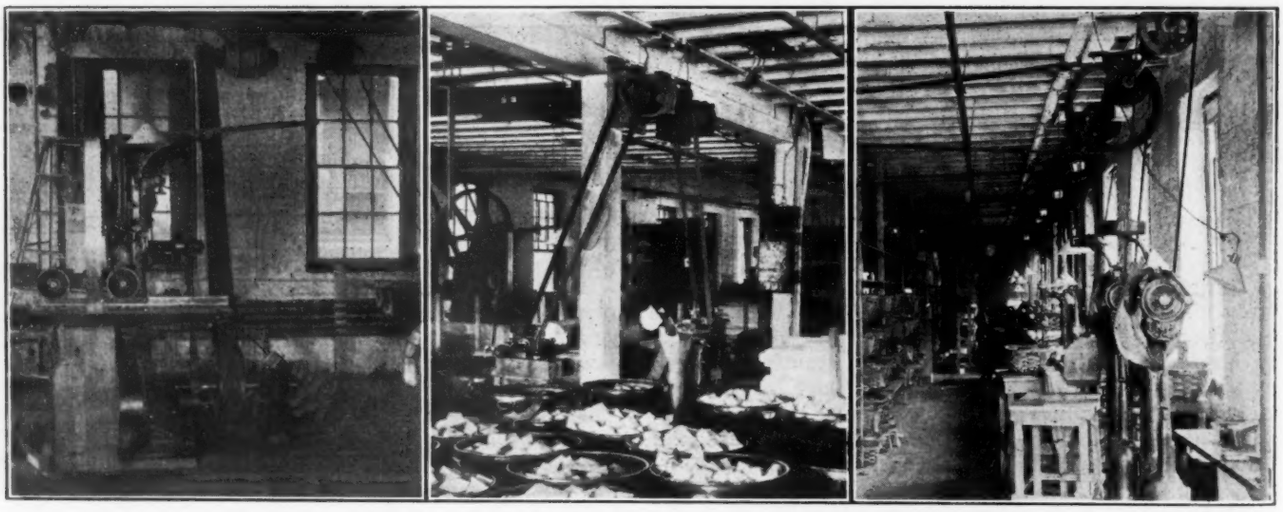


FIG. 1—MOTOR-DRIVEN WOOD HEEL TURNING MACHINE

The lighting equipment for the machines consists of 25-watt Mazda lamps in steel shades suspended by drop cords from the ceiling. The lamps over machines are controlled by individual ceiling switches operated by pull chains. The necessary general illumination is by 100-watt Type C gas-filled lamps in white enamel shades placed close to the ceiling. In addition to this equipment energy is required by a small electric iron used to remove the wrinkles in the kid used to cover the wood heels.

The motors are operated from a three-phase, 60-cycle, 550-volt circuit and the lighting equipment from a single-phase 60-cycle 110-volt circuit. The factory is connected to the lines of the Haverhill (Mass.) Electric Company. During the two months (June and July) it has been in operation, the average monthly energy consumption has been 5100 kw.-hr. with the average revenue according to the rate commanded of $150.



FIGS. 2, 3 AND 4—MOTOR-DRIVEN MACHINES FOR PREPARING BLOCKS FROM WHICH HEELS ARE TURNED AND ROW OF FINISHING MACHINES

ADVANCE IN TECHNICAL THEORY AND PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

THE OVERHEAD GROUND WIRE

Theory of Parallel Grounded Wires and Production of High Frequencies in Transmission Lines

THE use of the overhead wire for protection to transmission lines has been a more or less mooted problem among engineers for many years. A paper by Dr. E. E. F. Creighton on this subject, presented at the Cleveland meeting of the American Institute of Electrical Engineers, deserves careful attention since it places the practice of using overhead grounded wires on a firmer engineering footing and discusses as well the conditions which cause and suppress high-frequency surges.

The overhead grounded wire is used for three purposes: lightning protection, mechanical support for towers, and a test circuit. The functions of the grounded wire are subdivided into at least four categories: First, the vertical grounded wire; second, the lightning rod extending above the ground; third, the electrostatic induction in the horizontally situated wires, and fourth, electromagnetic induction.

The vertical wire prevents splitting of the poles. The lightning rod is of mooted desirability. The electrostatic induction for a given cloud on wires under various conditions is worked out in the paper. There are given also the protective values of overhead grounded wires in different positions and in different numbers. The effects of electromagnetic induction are taken into account, and theory is given to show that the grounded wire introduces into the main wave of induced lightning surge a superposed high frequency of electromagnetic induction.

A cloud charge is chosen of such value as to produce corona potential on a No. 000 B. & S. wire, strung at a height of 1000 cm. (33 ft.) above the surface of the earth. This storm cloud is used as a standard in all cases for comparison. The voltage induced on any wire by lightning is directly proportional to the height of the wire above the earth. The induced quantity is not quite proportional, due to the variations in the capacities of the wire at different heights. For heights between 30 and 60 ft. (9.1 and 18.2 m.), however, the quantity can be considered as approximately proportional to the height. The quantity induced on the wire is only slightly affected by the diameter of the wire. This leads to the conclusion that a small grounded wire is nearly as effective as a more expensive large one.

The theory is given to show that even on a non-grounded circuit a charge can be induced by a cloud and produce practically the same potentials as when the circuit is grounded. The only exception is that of circuits of short length.

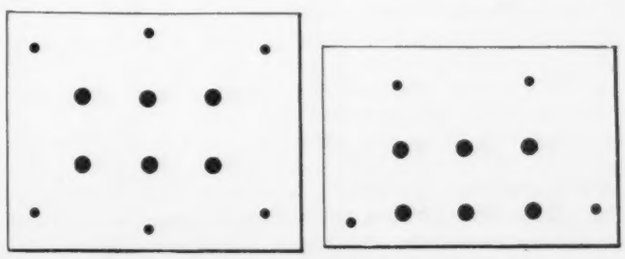
The instantaneous value of induced potential on a circuit is independent of the number of wires used. Using a greater number of wires reduces the quantity per wire but does not decrease the instantaneous value of the potential at the instant the cloud discharges to earth. Even the grounded wire may take the full potential and give no relief at the first instant. Whether it does or not depends upon how quickly the discharge takes place from cloud to earth, and how frequently along the line the grounded wire is earthed. There is, however, a screening of electrical energy by increasing the number of power wires. In other words, each surge has less energy although it has not initially less potential.

The two factors in the electrostatic protection of the overhead grounded wire are screening and increase of capacitance of line wires. The presence of the grounded wire reduces the quantity induced on each of the power wires, and incidentally after the cloud discharges to earth the grounded wire takes over part of the charge from the power wires and in taking it the capacitance of each power wire is increased. Therefore, with the same quantity of electricity the potential is reduced by this increase in capacitance.

As the charge runs to earth on the grounded wire at the instant the cloud discharges, it induces on the line wire by electromagnetic induction a considerable voltage in the usual condition of the overhead grounded wire with low resistance in the earth connections, and from which part of the protection afforded by the grounded wire is lost by the fact that the energy oscillates in the ground circuit and is transferred to the power wire.

The natural frequency of this wave train is found by multiplying 183,000 miles (300,000 km.) per second by the number of earth connections per mile of grounded wire. The frequency is usually over a million cycles per second.

Traveling waves are more or less absorbed as they pass each successive loop of the grounded wire, according to the value of the resistance of earth connection. In any case an endeavor should be made to have the resistance in the earth connection somewhere near the critical damping value. This prevents initial oscillations in the ground circuit, and also increases the rate of absorption of a traveling wave.



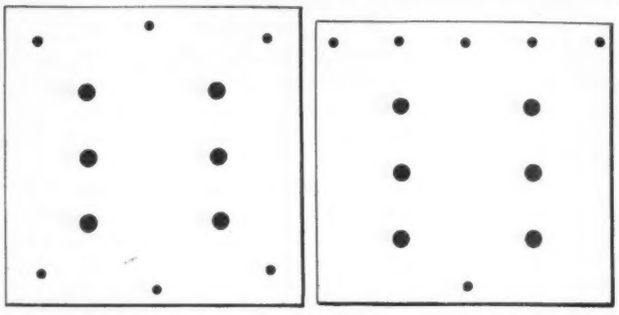
FIGS. 1 AND 2—ARRANGEMENTS OF SIX AND FOUR GROUND WIRES IN HORIZONTAL FORMATION

A slight amount of high frequency is produced in a circuit by transposition of power wires. This may be of the order of 2 per cent to 5 per cent of the main voltage.

The general deductions for practical use taken from the theory given are as follows: From a theoretical standpoint a single grounded wire should be placed as near as practicable to the power wire in order to get the greatest electrostatic protection. The grounded wires are a little more effective when placed above a power wire than when placed below it.

In installing overhead grounded wires the greatest advantage can be obtained by keeping the overhead

grounded wires as far apart as possible; that is to say, installed as far as practicable on opposite sides of the power wires. The protective value of the second wire will then have its full maximum possible value. Also from the electromagnetic standpoint, the two wires should be placed, so far as practicable, on opposite sides of a power wire in order to reduce to a minimum the transfer of surge energy to the power wire.



FIGS. 3 AND 4—TWO ARRANGEMENTS OF SIX GROUND WIRES

Various locations of grounded wires are shown in Figs. 1, 2, 3, 4, 5.

Fig. 1 shows two parallel circuits of six wires arranged in horizontal formation and six grounded wires separated as widely as possible from each other, and yet as near to the power wires as mechanical clearance will permit. The grounded wires are arranged in pairs symmetrically so as to decrease the electromagnetic induction. The two outside lower wires might be raised to the same position as the corresponding one in Fig. 2 without making much difference in the protective value, or the two upper outside wires might be lowered on each side without making a very great difference in the protection. Mechanical conditions of support will be the criterion. The simple rule is to space the overhead grounded wires as far from each other as convenient, but as near to the power wires as is safe. Fig. 2 shows a desirable location for four grounded wires on the same type of circuit as Fig. 1. Fig. 3 shows a distribution of six grounded wires for two three-phase circuits vertically hung. In some cases it may be desirable to keep the grounded wires within the same width as the two circuits. Fig. 4 shows another disposition of the six grounded wires which is not so good from the electromagnetic standpoint, but which is somewhat better from an electrostatic standpoint. The lower wires of the vertically hung circuits are greatly protected by their lesser height above earth, and therefore they do not need the presence of grounded wires as much as the upper power wires.

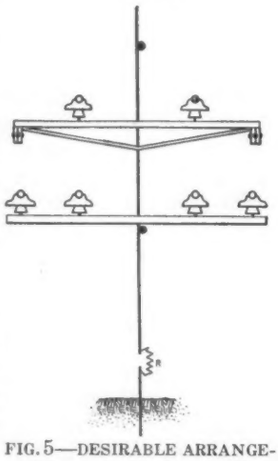


FIG. 5—DESIRABLE ARRANGEMENT OF FOUR GROUND WIRES WITH NON-GROUNDED PINS

Fig. 5 shows a desirable distribution of four grounded wires where non-grounded pins on the insulators are used. To preserve the insulation afforded by the wooden cross-arm the metallic connections of the laterally grounded wires are carried free of the cross-arm, in fact, long metal braces might be used in this case. At one point in the circuit is shown a series resistance to bring the total resistance in the grounded loop up to a value at least equal to one-fifth of the critical damping resistance.

Installations, Systems and Appliances

Appreciation of Electricity to Agricultural Purposes.—W. T. KERR.—A long abstract of a paper read before the (British) Municipal Electrical Association. The author gives an account of the supply that is being given to the farmers around Hereford, and the importance of an agricultural load is strongly emphasized. A system of light and comparatively inexpensive transmission line is used. The greatest obstacle to cheap rural supply is the question of way-leaves. Farmer installations and electric ploughing are discussed. Fig. 6 gives typical

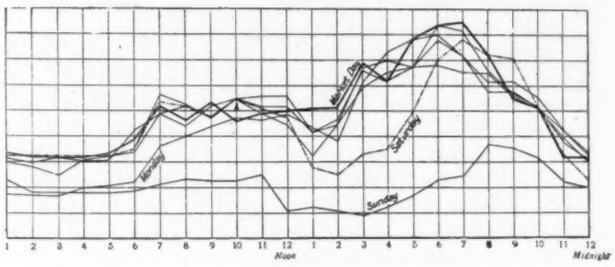


FIG. 6—VARIATIONS IN DAILY RURAL LOAD AT DIFFERENT TIMES OF WEEK

curves of the total output for a week. The influence of the agricultural load is clearly shown. The horsepower of motors in use and units consumed generally in carrying out the operations are as follows:

TYPICAL LOAD CURVES DUE TO SERVICE IN AN AGRICULTURAL SECTION

Cider making	160 hp.	67,404 units
Milling	142 hp.	347,856 units
Farmers' supply	106 hp.	19,673 units
Water pumping	157 hp.	331,295 units
Sawmilling	130 hp.	22,801 units

After the war it is proposed to carry out a scheme of high-tension three-phase supply for the Hereford area, there being a growing demand for electricity from farmers and private country residences that cannot be met by a 440-volt three-wire supply.—London *Electrician*, June 23, 1916.

Electric Cooking.—An illustrated description of a new electric restaurant at Golder's Green, N. W.—London *Elec. Review*, June 23, 1916.

Electric Hot-Water Supplies.—H. H. HOLMES.—The author points out the recent great advance in the sale of electric cooking utensils and wonders why so many electrical engineers consider electric hot-water supplies for household use as impractical. He thinks that "electric hot water is by no means so hopeless a proposition, and if the signs of to-day count for anything it will not be many years before more electricity will be sold for hot-water supplies than ever will be sold for cooking—not that cooking will not progress, but because electric hot water will demand a greater number of units per household and offers greater possibilities in the way of cheap generation to the central station." The first real efforts to provide practical electric hot-water apparatus were in the shape of the 100-per cent load factor or heat storing apparatus. The author explains why this was given up and sketches the subsequent evolution.

Most electric hot-water installations until recently depended on a central hot-water tank supplying the whole premises by means of pipes. On careful test it was found that the heat losses in the pipes in the best cases were at least equal to the energy usefully consumed, and in the worst cases less than one-fifth of the energy used was represented by hot water in the bath or sink. The best practical arrangement has proved to be the provision of separate hot-water tanks at each point where hot water is drawn. The tanks provide a bath of hot water in twenty minutes from the time

of switching on, and the current is thermostatically cut off after the desired temperature is reached; the current cannot be switched on again except by hand. When the tank is well lagged, the water keeps hot several hours, and the heat losses inseparable from a constantly ready hot-water supply are thus eliminated. The initial cost of the apparatus is quite low; the size of tank adopted is 15 to 20 gal., the temperature at which the thermostat operates being fixed at 150 deg. Fahr. to 160 deg. Fahr. The cold water inlet only is controlled by a tap, the outlet being left open. When a bath is required, the cold water cock is opened, and the hot water forced out of the tank, followed by sufficient cold water to bring the bath temperature down to 95 deg. Fahr. to 100 deg. Fahr. In practice there seems to be no disadvantage by reason of the apparatus taking twenty minutes to heat up, and no complaints arise from this source. For sinks and cleaning water a small apparatus is provided. The tank or container is heavily lagged and holds about 1½ gal.; the temperature at which the thermostat operates is fixed at 190 deg. Fahr. The loading is 4 kw., and thus 1½ gal. of water at 190 deg. Fahr. can be procured every ten minutes. In the Marylebone district the demand for hot-water apparatus is an increasing one, and the installations carried out have proved eminently satisfactory to both user and current supplier. The possible business needs only advertising to be obtained and held, so that hot-water heating appears to be a most profitable undertaking.—London *Electrician*, June 23, 1916.

Book Reviews

ENGINEERING AS A CAREER. A Series of Papers by Eminent Engineers. Edited by F. H. Newell and C. E. Drayer. New York: D. Van Nostrand Company. 214 pages. Price, $1.

Most young men possess only a vague idea of the engineering profession and many parents share this haziness. "Engineering as a Career" is intended not only as a guide to young men considering engineering as a life work, but also as an aid to the parent and professional advisor in vocational work. The book contains many articles by prominent engineers and other experts, and explains in detail each of the many different branches of engineering, with the qualifications and the education necessary for success and the opportunities that await the young man choosing engineering as a career.

WIRELESS TELEGRAPHY AND TELEPHONY. A Handbook of Formulæ, Data and Information. By W. H. Eccles. London: The Electrician Printing & Publishing Company. 418 pages. 322 illustrations Price, 12s. 6d.

The amount of data included in this book is so great that it cannot be more than indicated in a review. In addition to providing nearly all the tables, conversion factors and basic formulæ commonly used in radio work, the author has summarized and briefly restated a vast quantity of the technical literature of the art. That this work has been well done is evident from even cursory inspection; indeed, Dr. Eccles' name is an assurance of its general excellence.

The book comprises an index of fourteen pages, a section of tables and formulæ of 115 pages, a 243-page division of general technical, experimental and theoretical information and a twenty-eight-page glossary of terms used in radio telegraphy and telephony. The two main sections of the book cannot be sharply divided, inasmuch as many of the formulæ are presented with full explanations of their derivation assumptions and their applicability, while in the "general information" portion of the book a number of tables and formulæ are quoted. The arrangement and indexing is such, however, that little difficulty is encountered in locating desired data.

While the handbook is intended mainly for reference, it repays careful study as a descriptive text. The data as to apparatus and methods in actual use are particularly interesting, although not altogether correct as to American systems.

The author's discussions of wave propagation, station efficiencies and contact and "ionized gas" (which might better be "vacuum tube") detectors are especially worthy of note. In the first part of the book are given some twenty "Abacs" or graphical charts for rapid computation; most of these are drawn between two simple quantities such as statute and nautical miles, but the first one gives directly the relations between wave length, capacity and inductance. As a whole, the volume is certain to become one of the most used publications on radio, and should be in the reference library of every radio engineer.

INVENTIONS AND PATENTS. By Philip E. Edelman. Published by D. Van Nostrand Company, New York, 1915. 288 pages, four illustrations. Price $1.

This book is a comprehensive discussion of patents and their uses, and is designed to supply information of interest and value to inventors, investors and manufacturers. While the subject matter is necessarily technical in the legal sense, the author does not make use of the peculiar vocabulary which so often discourages the layman when he attempts to investigate for himself a point of law. This volume is a sort of elementary textbook for those who are interested in patents, and seems to stand alone.

The sixteen chapters describe the development of the present patent system, discuss the functions of the inventor, the attorney, the examiners, the assignees and the courts, and explain in detail the processes in prosecuting United States patents. The book is not intended to be exhaustive, nor to assist inventors in preparing specifications without the aid of an attorney; the third chapter, in fact, opens with the old saw to the effect that 'the man who is his own lawyer has a fool for a client.' Numerous abuses practised by unscrupulous attorneys are quite frankly expounded, however, and, by careful study, even the inexperienced inventor may secure a fairly clear idea of the respective values of broad and narrow "combination" claims of just what does and what does not constitute invention, and of the processes involved in patent interferences and infringement suits.

An appendix of over seventy pages gives digests of important decisions and shows various forms of assignments, etc. There is a bibliography given, and a chapter of quotations "on inventions and inventors" from, among others, Milton, Dickens and Walker ("On Patents"). There is also a chapter on foreign patents and the various international regulations with regard to them. The book is, on the whole, so full of useful data that it is well worth reading. In spite of occasional statement of opinions questionable as to logic or accuracy, the mass of classified facts should prove helpful to a majority of those interested in patents.

Book Received

PRACTICAL PHYSICAL CHEMISTRY. By J. B. Firth. New York: D. Van Nostrand Company, 178 pages, illustrated. Price, $1.

D. H. MC DOUGALL

Men of the Industry

Changes in Personnel and Position— Biographical Notes

Douglas H. McDougall, the new president of the Canadian Electrical Association, is treasurer of the Electrical Development Company, the Toronto & Niagara Power Company and the London (Ont.) Electric Company. Mr. McDougall was born in Toronto in 1874. Following experience in accounting work in the United States, he returned to Toronto in 1893 as treasurer of the Electrical Development Company of Ontario, Ltd., taking charge of the finances of this company, whose splendid hydroelectric plant at Niagara Falls is one of the most notable power structures in the world. In 1908 these holdings were leased to the Toronto Power Company and Mr. McDougall was appointed assistant to the general manager until, in 1911, the Toronto Company purchased the entire stock of the Toronto Electric Light Company and Mr. McDougall was appointed assistant to the manager of the enlarged organization. At the present time, in addition to holding the positions noted, Mr. McDougall is also secretary of the Niagara Falls Gas & Electric Light Company.

A. G. DeClercq, who was formerly supervisor of the station construction division of the Commonwealth Edison Company, Chicago, Ill., has been appointed assistant construction superintendent for the company, to succeed the late John C. Manley.

A. P. Broadhead, formerly assistant construction superintendent for the Montreal Light, Heat & Power Company, Montreal, Quebec, Canada, has been appointed superintendent of the Drummondville (Quebec) division of the Southern Canada Power Company. Mr. Broadhead's headquarters will be at Drummondville.

Roy E. Schaulin, for the past three years a field member of the business staff of the New York and Chicago offices of ELECTRICAL WORLD, has resigned to accept the position of manager of the New York sales office of the Franklin Electric Manufacturing Company of Hartford, Conn., maker of incandescent lamps. Mr. Schaulin was formerly engaged in sales work for the Westinghouse Lamp Company at Pittsburgh and Chicago.

S. Fred Smith, general manager of the Salem Electric Lighting Company, Salem, Mass., is receiving the congratulations of his friends upon the twenty-fifth anniversary of his appointment as executive head of the Salem company.

J. B. Long of the contract department of the Commonwealth Edison Company, Chicago, Ill., who was formerly with the General Electric Company at Schenectady and the Holophane Glass Works at New York, has been appointed new business manager of the Central Power Company, Grand Island, Neb.

P. A. Staples, who was recently appointed vice-president and general manager of the New Jersey Power & Light Company of Dover, N. J., successor to the Eastern Pennsylvania Power Company, operating in Dover, Bernardsville, Boonton, Rockaway, and other nearby communities, still retains his position as second vice-president of the Sandusky Gas & Electric Company of Sandusky, Ohio, which position he has held for the last two years.

J. W. Thorne has resigned as commercial agent and electrical superintendent of the Beaumont (Tex.) Electric Light & Power Company to join the commercial department of the Texas Power & Light Company. Since graduating from the University of Kentucky in 1907, Mr. Thorne has been with the General Electric Company in its testing and engineering departments at Schenectady and Pittsfield, and in commercial work in Texas. Mr. Thorne is at present investigating the possibilities of electric drive in the Electra oil field in north Texas, applying his experience gained in developing this class of business in the Spindle Top field near Beaumont in the Gulf Coast country.

C. E. Skinner, who was recently elected by the membership of the American Institute of Electrical Engineers to serve on the Institute's Edison medal committee, is one of the well-known research engineers of the country and is at the head of the research department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. Mr. Skinner was born May 30, 1865, near Redfield, Ohio, and was graduated with the class of 1890 from Ohio State University, Columbus, Ohio. He first joined the Westinghouse organization in that year, and in 1891 organized and carried on the insulation testing for the company, which prior to that time had done no dielectric testing. In 1892 he was transferred to the electrical laboratory, doing various kinds of work, including iron testing, insulation testing, general investigation work, etc. In 1895 Mr. Skinner was placed in charge of insulation design in the engineering department and of insulation testing in the factory. In 1902 he took charge of the insulation division of the engineering department, together with the chemical and physical laboratories, and in 1906 organized the research division, with which work he has since continued. Mr. Skinner is a member of many professional societies and has contributed numerous important papers to the proceedings of the A. I. E. E., the American Society for Testing Materials, and the National Electric Light Association, and his special investigations have taken him to various parts of the United States, Canada, Mexico and Europe.

C. E. SKINNER

Obituary

L. A. Williams, local manager for the Nebraska Gas & Electric Company at Norfolk, Neb., was accidentally electrocuted Aug. 8, while supervising line repairs at a point twenty miles west of Norfolk.

Thomas D. Watson, New York manager of the New York office of the Trumbull Electric Manufacturing Company, Plainville, Conn., died, Aug. 16, at his home in Westfield, N. J. Mr. Watson was well known in the electrical industry about New York, having held his position with the Trumbull Company for fourteen years.

Harold Lomas, for more than thirteen years a member of the sales department of the Crocker-Wheeler Company, was killed, July 1, while serving with the British army in the drive on Friecourt, France. Mr. Lomas served the company as manager of its Denver and Baltimore offices and later held the position of acting secretary of the Crocker-Wheeler company.

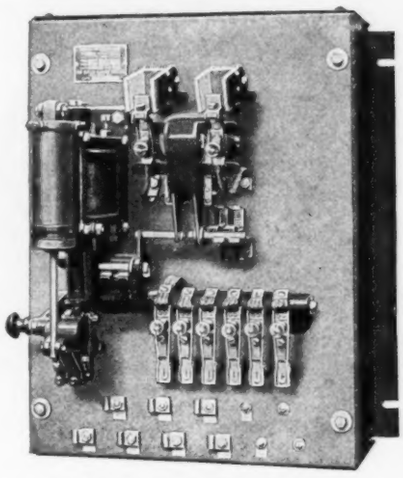
William Christy, vice-president of the Northern Ohio Traction & Light Company, died at Akron, Ohio, Aug. 9, at the age of fifty-seven years. Mr. Christy was a pioneer in electric railway work, electrifying an early street-car line and constructing the interurban which ran from Cleveland to Bedford, Ohio. His death followed an operation for appendicitis.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Automatic Starting and Speed Control Device

The automatic starter for slip-ring motors shown in the accompanying illustration has been developed by the Cutler-Hammer Manufacturing Company of Milwaukee, and consists of a double-pole solenoid main switch for



AUTOMATIC STARTER FOR SLIP-RING MOTORS

closing the primary circuit and a number of switches operated by a common solenoid for controlling resistance in the secondary circuit. This solenoid, however, is operated in a manner different from that of the conventional solenoid-operated self-starter in that where the circuit to the self-starter is first closed, the solenoid is energized and it lifts its plunger instantly, inserting all the resistance in the secondary circuit of the motor. After the solenoid plunger has reached its highest position it closes a pilot circuit, which causes the primary switch to close and connect the motor across the line with all resistance in series. The closure of the primary switch in turn opens the circuit to the pilot solenoid, so that it is without current. As the pilot solenoid pulls up to its highest position it is latched there until its current is cut off by the closure of the primary solenoid and the latch is then automatically released. The plunger of the solenoid is now free to drop against the action of the dashpot. The gradual dropping of the solenoid plunger causes the switches which control the resistance in the secondary circuit of the motor to gradually short-circuit the motor and bring it up to speed. The time of acceleration can be adjusted by means of an adjusting valve on the dashpot.

With this self-starter the only constant consumption of energy is in the primary solenoid switch, it is pointed out, while the amount of energy taken by the secondary solenoid is negligible, since it is energized only for an instant. The motor can be started with a minimum amount of inrush current, as the number of accelerating switches for cutting out the secondary resistance is in proportion to the motors to be controlled. The number of these switches is six; two for each phase of the secondary motor circuit, and as these phases are cut out in rotation, the motor accelerates with seven different speeds or steps.

The motor may be run at different speeds between zero and maximum. The shaft carrying the accelerating switches is connected through two levers pivoted at the same point, one of which is equipped with a segment provided with a number of holes, and the other is provided with a pawl which can be slipped into any one of these holes. Thus it is possible to engage the two levers in different relative positions and cause a variable number of switches to be closed when the plunger has reached its lowest position. The motor can, therefore, be at any one of seven speeds which may be desired without having the pilot solenoid energized the entire period of operation of the motor.

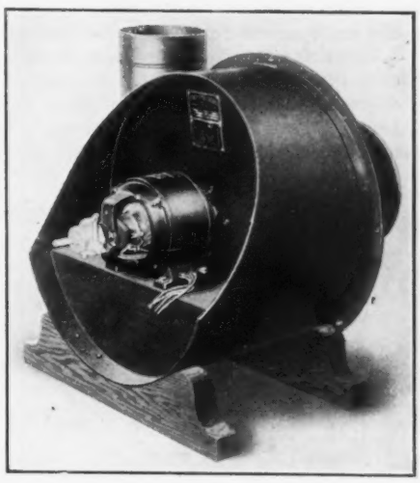
The controller may be arranged for operation from any pilot device, such as a float switch or pressure regulator, or it may be operated from push buttons. The latter-named method of operation is particularly desirable for use on printing presses and similar work. In this case it is possible to start and stop the motor from any number of places by the operation of an "on" and "off" push button at each one of these stations. The speed-setting device can be locked so that the operator cannot run his motor at a speed higher than that which is selected by the superintendent or other person in authority.

Heat-Resisting Metal

"Insuluminum," a recently patented metal with heat-resisting qualities said to be greatly superior to iron and steel, is, according to claims of the manufacturer, especially adapted for use on those parts of soot blowers, pyrometers, boilers, superheaters, economizers, stokers, annealing ovens, condensers, etc., exposed to continuously high temperatures. The metal is being produced by the Diamond Power Specialty Company, Detroit, Mich., and is being used extensively in the construction of the company's soot blowers. Since the adoption of this metal, the manufacturer states, the volume of sales of soot cleaners has more than doubled and it is estimated that for the year begun Aug. 1, 1916, boilers with a total rating of more than 1,000,000 hp. will be equipped with "Diamond" soot-cleaning apparatus.

Motor-Driven Organ Blower

Not so long ago, when organs were operated on from 2-in. to 3-in. water column pressure they were generally operated by hand; now, however, as high as 20,000 cu. ft. of air per minute is used, at pressures of from 4 in. to 40 in. water column, and hand operation is practically out of the question. For the past twenty-five years The Organ Power Company of Hartford, Conn., has been devoting its attention to the solution of organ-blowing problems. The pioneer work included experiments with rotary and reciprocating water motors, but electric blowers have now been adopted as standard. These electric blowers were first of wood-box construction, then of wood and metal, and finally of cylindrical metal construction. Of the last-named type, the open cylindrical steel "Orgoblo," illustrated herewith, has recently been developed. Blowers of the model shown received the highest award at the Panama-Pacific International Exposition at San Francisco. The large official organ was



ELECTRIC ORGAN BLOWER

operated by one of these blowers and a number of other organs winning prizes at the exposition were also blown by them.

Alternating-current and direct-current motors varying in capacity from 2 hp. to 15 hp., made by the Westinghouse Electric & Manufacturing Com-

pany of East Pittsburgh, Pa., are employed to operate the blowers. The motors are directly connected to the fan of the blowers and possess characteristics which specially suit them for blowing work. In the Spencer steel "Orgoblo" the air has a continuous passage throughout the machine, thereby avoiding losses incident to stopping and starting the air between stages, and is said to be the only machine in which the loss by fan side leakage has been entirely overcome. A two-stage or compound blower is utilized. To meet the demand for a low-priced blower a special fan-type machine is made which runs at a high speed, but is not recommended for use unless it can be placed some distance away from the organ so that the noise will not be heard. A great many multi-pressure blowers are also made having several discharge openings.

Copper Clad Steel Wire

The Page Woven Wire Fence Company of Monessen, Pa., has secured the exclusive right to draw and sell "Aristos Copperweld" copper-clad steel wire, which is made from rods manufactured by the Copper Clad Steel Company, Pittsburgh. The weld between the copper and steel is without voids, the makers point out, and is of such a nature that torsions, twists, strains, hammering, etc., will not cause the copper covering to be separated from the steel center or core. Even changes of temperature from extreme heat to a sudden plunge in cold water have no effect, it is declared, on the weld. The material is, furthermore, proof against external corrosion to the same extent that copper is, and as the weld is said to be perfect no moisture can enter between the two metals—hence electrolysis can never take place.

After the wire is drawn it is given the most severe tests, the manufacturer asserts, for bending qualities, breaking strength, torsion, elongation and conductivity. From the time it is first broken down from the rods until its final wrapping, it is handled with gloves to insure its being absolutely free from dirt and grease.

According to claims of the maker, the wire has a tensile strength about 60 per cent greater than hard-drawn copper wire of the same size, and will stand approximately 126 per cent more strain than copper wire before reaching its elastic limit. The wire also weighs approximately from 7 per cent to 10 per cent less than copper wire of the same diameter and length, and is therefore not only cheaper in first cost but, on account of its greater strength, cheaper in maintenance. The wire is furnished in two grades of conductivity—namely, 40 per cent and 30 per cent—and also in a mechanical grade. Under special arrangements higher grades of conductivity can also be made. The material is manufactured in sizes of from 4/0 to 17 B&S Gage. Smaller sizes can also be furnished under special arrangements. The material can also be furnished in weather-proof insulation and in rubber-covered twisted-pair forms.

The wire can be used to advantage, the maker points out, for automatic block signal systems, electric light and transmission lines, telephone and telegraph systems, etc. Railroad companies may also employ it as tie, line, bond or signal wire.

Boiler-Compound Feeder

An automatic boiler-compound feeder which is designed to feed continuously the softening reagent into the boiler-feed water in direct proportion to the quantity of water evaporated has been developed by the Taber Pump Company, Buffalo, N. Y. In the accompanying illustration are shown three methods of injecting the softening reagent with the Taber compound feeder. The reagent may be injected either in the discharge pipe of the boiler-feed pump or in the inlet pipe where there is a water tank provided and the reagent can be directly discharged into this tank. The feeder is self-contained and can be connected to the drain cocks of the boiler-feed pump as shown.

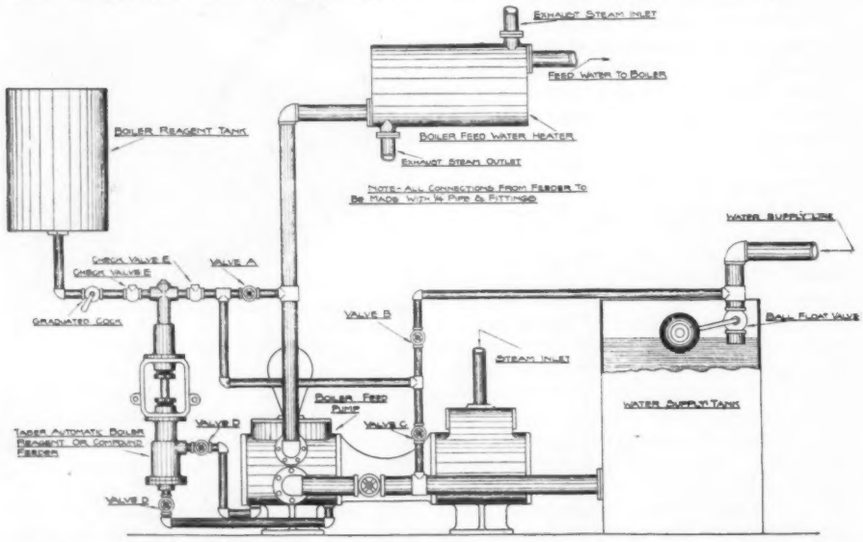


DIAGRAM SHOWING THREE METHODS FOR INJECTING SOFTENING REAGENT INTO BOILER-FEED WATER

Starting Switch on Single-Phase Induction Motors

Single-phase induction motors on which the split-phase method of starting is utilized require a switch to cut out the starting winding. This switch is always arranged to operate by centrifugal force just before the motor reaches full-load speed. The old type of switch operated by the centrifugal force of the contact fingers, while reliable for light service, it is declared, did not meet the increasingly heavy demands put upon single-phase motors.

A new switch developed by the Westinghouse Electric & Manufacturing

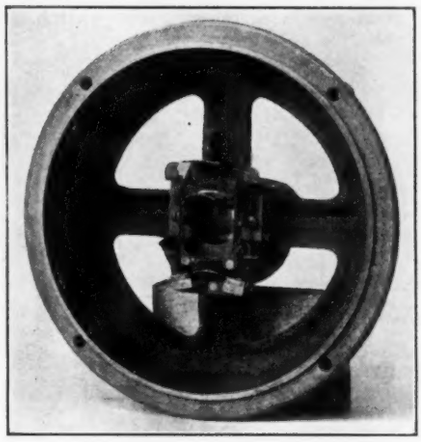


FIG. 1—STATIONARY PART OF SWITCH ON BRACKET

Company of East Pittsburgh, Pa., for use on its small single-phase induction motors has been designed for great endurance and reliability combined with simplicity. The switch consists of two parts, a stationary part mounted on the motor bracket, and a rotating part mounted on the shaft. The former consists primarily of one stationary and one movable punching, each of which carries two heavy copper block contacts insulated from the punching, the contacts on the upper part being short-circuited by a phosphor-bronze spring. This part is free to move up and down, thus opening and closing the circuit with the two blocks on the stationary part. This movable part is held in either of its extreme positions by means of two steel springs near the upper part of the switch, which give it a certain amount of over-travel so that when it is pushed in one direction through about half of its travel it will jump the remainder of the way.

The operating mechanism for the switch is mounted on the shaft and consists of three weights arranged in an approximate ring. These weights run between two lips on the sliding part of the switch. When the motor slows down the springs pull the weights together and they then strike the lower lip, throwing the switch into the closed position. Owing to the over-travel of the switch the lips move out of contact with the ring in both the open and closed positions so that the only time the rotating part is touching the stationary part is at the transition period.

The switch makes a quick clean break, it is pointed out, and the contacts are large, permitting quick radiation of heat. By thus keeping the contacts cool arcing is reduced to a minimum. The contacts are designed to

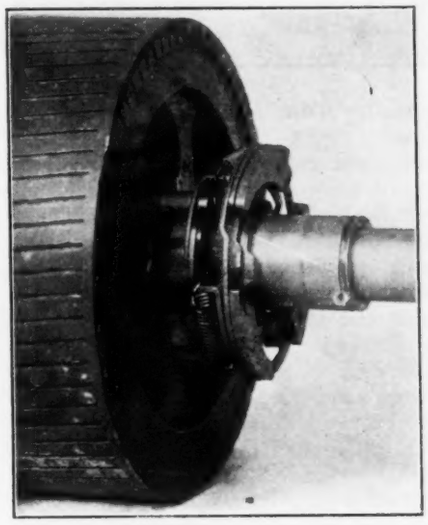
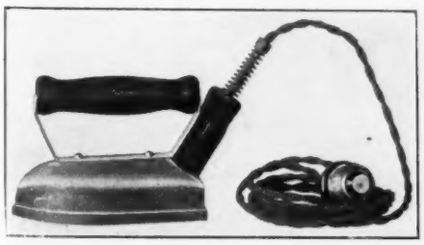


FIG. 2—REVOLVING MEMBER ON SHAFT

have a wiping action which keeps a clean contact surface. The mounting of the stationary element is of metal, insuring correct alignment and spacing, while the only insulation used is the bakelite "micarta" used to separate the contacts from the punchings. The illustrations show both parts of the switch mounted, the revolving member on the shaft and the stationary member on the bracket. One of these switches selected at random from stock was operated 1,000,000 times at more than full load current, and at the end of the test was still in good operating condition.

Light-Weight Electric Iron

Although not a toy, the "Baby" electric iron, as it is called, shown herewith, will be of special appeal, the manufacturers claim, to mothers who wish to provide their daughters with useful gifts so that they can help with the family washing and at an early age de-



1-LB. ELECTRIC IRON

velop habits of industry. It weighs only 1 lb., and is particularly useful, it is pointed out, for light pressing of lingerie, laces, handkerchiefs, etc. The iron is equipped with connector plug, 6 ft. of maroon cord and attachment plug, and is rated at 90 watts. It operates on from 100 volts to 130 volts. A feature of the device, to which the maker directs particular attention, is the simplicity of it, two solid castings clamped together with two screws making it fool-proof, it is asserted. The heating element is imbedded in cement. The iron is also very useful for persons traveling because of its light weight and compactness. The device is being placed on the market by the International Electric Company, Indianapolis, Ind.

Low-Priced Toy Transformer

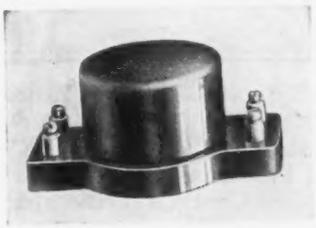
In connection with the development of its new "Danditoy" transformer, the Thordarson Electric Manufacturing Company, 501 South Jefferson Street, Chicago, Ill., has made some interesting discoveries regarding the general status of the electric-toy industry. Prior to last year, it has found that the demand for toy transformers depended largely on the use of electric trains. These trains, as a rule, required a considerable amount of energy for their operation, and therefore transformers of a type larger than that shown were needed. The manufacturers of electric toys have long considered the business too restricted, it is declared, and efforts during the last few years have been made not only to increase the use of electric trains but also to increase the

SMALL-SIZED TOY TRANSFORMER

number of small electric-toy outfits. In other words, the idea was to obtain quantity production. Coincident with the extension of the electric-toy business there grew a demand for a low-priced toy transformer, and for that reason the device shown was brought out. The normal rating of the transformer is 40 watts, although it can be operated at 50 watts with perfect safety, the maker points out. A voltage regulator is placed on the top of the case, giving a range of potentials from 0 volt to 27.5 volts in steps of 2.5 volts each. A name plate is placed on the top of the transformer, which enumerates the different connections required for the different voltages. The transformer is neat in appearance and small in size, its weight being 3 lb. It is equipped with 7 ft. of flexible cord, together with suitable attachment plug.

High-Frequency Buzzer

A high-frequency buzzer for wireless testing work developed by the Clapp-Eastham Company, 139 Main Street, Cambridge, Mass., is shown herewith. It is designed to operate on one dry cell and to simulate exactly the pitch or note of high spark frequency radio transmitters. The manufacturer claims that it will also operate continuously for hours at constant amplitude without change of period, and that it is easily adjustable over a wide range. The device is compact, measuring 2.75 in. long by 1.625 in. wide by 1.125 in.



BUZZER FOR WIRELESS TESTING WORK

high. It weighs 1.5 ounces. The two pairs of binding posts (one pair for battery connection and one pair for connection across the break, are arranged outside the case so that connections can be made without removing the cover and no holes need be bored for bringing out wires when mounted on a cabinet or table. A condenser and inductance connected across the contact points of the buzzer provide a source of oscillations of constant amplitude and constant wave length for laboratory and testing purposes.

Steel Battery Cabinet

A single steel cabinet adapted particularly for use with batteries made up of standard round dry cells, 2.5 in. by 6 in. in size, as shown in the accompanying illustration, has recently been brought out by W. R. Ostrander & Company, 371 Broadway, New York. The so-called wireless connectors are of spring tempered phosphor-bronze strips, as shown, having strong tension and bearing down firmly on both the carbon and zinc terminals of the cells. This insures a positive contact, it is pointed out, and at the same time affords, when required, a quick and easy release. The connectors also prevent loose connections, short circuits, etc., the maker asserts, and are not affected by vibration. The cabinet is of 16-gage steel, the door being hinged and equip-

STEEL CABINET FOR DRY BATTERY WITH STRIP CONNECTORS

ped with padlock. Knockouts for 0.5-in. conduit are provided in each side. The cell support is of hard wood, saturated with an insulating compound and paraffine. It has a ventilated bottom and is recessed for the isolation of the cells. The method of connecting the cells can also be utilized when it is desirable to employ any of the standard forms of primary batteries.

NEWS OF THE INDUSTRY

A Review of Activities in the Electrical Manufacturing, Selling and Central-Station Fields

CHEMICALS MADE BY ELECTRICITY

Report of the Bureau of the Census Shows the Value of Products in 1914 to Have Increased 60 Per Cent Over the 1909 Production

According to a bulletin on the 1914 census of manufactures with respect to the production of chemicals and allied commodities by means of electricity, the chief products in this country were aluminum, phosphorus, silicon, sodium, carbon in its allotropic form of graphite or plumbago, chlorine, oxygen and hydrogen, among elementary substances; ferroalloys, copper, titanium and vanadium compositions, and other alloys; calcium carbide; carborundum (silicon carbide) and alundum (artificial corundum), largely used as abrasives; caustic soda, caustic potash, sodium peroxide, chloride of lime or bleaching powder, and other hypochlorites; carbon bisulphide and muriatic acid.

The manufacture of electrochemical products was reported by thirty-six establishments in 1914 and by thirty-four in 1909. The total value of products in 1914 was $29,661,649, an amount which exceeded the corresponding figure for 1909 by $11,210,188, or 60.8 per cent. The statistics with respect to specific groups of products are as follows:

Chlorates were manufactured with the aid of electricity by five establishments in both 1914 and 1909. The production in 1914 amounted to 8304 tons (of 2000 lb.), valued at $1,131,316, exceeding that of 1909 by 43.5 per cent in quantity and by 25.1 per cent in value of products.

Hypochlorites were manufactured by four establishments using electrochemical methods in 1914 and by five in 1909. The production in 1914, chiefly chloride of lime (bleaching powder), was 73,197 tons, valued at $1,714,837, representing an excess of 59.2 per cent in quantity and 13.8 per cent in value over that of 1909. The total production, both chemical and electrochemical, was 111,076 tons, valued at $2,578,269, of which the electrochemical products constituted approximately two-thirds.

Caustic soda, caustic potash and lye were manufactured by five establishments in 1914, the production aggregating 48,663 tons, valued at $2,309,511. All these establishments reported caustic soda, and one reported caustic potash and one caustic lye. The total production of caustic soda in 1914 by chemical and electrochemical processes was 212,539 tons, valued at $6,657,514, the production by electrochemical methods constituting a little more than one-sixth of the total.

Ferro and other alloys, including alloys of aluminum, copper, manganese, silicon, titanium and vanadium, were produced to the value of $2,859,482 by seven establishments in 1914. Figures for 1909 are not available. In addition, there were produced in electric furnaces in 1914 by fourteen establishments, classified in the iron and steel industry, 21,548 tons of foundry iron and steel ingots and castings, chiefly direct steel castings.

Oxygen and hydrogen to the value of $68,441, chiefly oxygen, were produced in 1914 by electric processes in five establishments. Figures for 1909 are not available. The values of the oxygen and hydrogen produced in 1914 by all establishments and by all methods, including the fractional evaporation of liquefied air, were $1,829,446 and $16,671 respectively.

The output of aluminum, calcium carbide, abrasives, electrodes, sodium and sodium peroxide, phosphorus, silicon, chlorine, carbon bisulphide and muriatic acid by electrochemical or electrometallurgical methods cannot be reported separately without disclosing the operations of individual establishments.

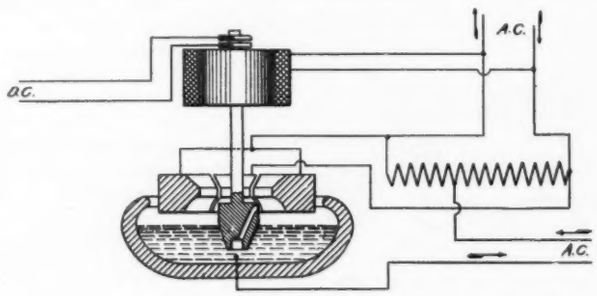
The comparative statistics for 1914 and 1909 are summarized in the following statement:

	1914	1909
Number of establishments	36	34
Products—		
Total value	$29,661,649	$18,451,461
Chlorates:		
Number of establishments	5	5
Tons	8,304	5,785
Value	$1,131,316	$904,550
Hypochlorites:		
Number of establishments	4	5
Tons	73,197	45,970
Value	$1,714,837	$1,506,831
Caustic soda, caustic potash, and lye:		
Number of establishments	5	
Tons	48,663	
Value	$2,309,511	
Ferro and other alloys:		
Number of establishments	7	
Value	$2,859,482	
Oxygen and hydrogen:		
Number of establishments	5	$16,040,080
Value	$68,441	
All other, named in order of value—aluminum, calcium carbide, abrasives, electrodes, sodium and sodium peroxide, phosphorus, silicon chlorine, carbon bisulphide, and muriatic acid:		
Number of establishments	17	
Value	$21,578,062	

Converting High to Low Frequency

Alexander T. Kasley, in Patent No. 1,193,485, issued to him, suggests a very neat arrangement whereby the half waves of a high frequency circuit can be rectified to give a current of a lower periodicity with improved wave form.

A mercury jet or pump is operated by a synchronous motor driven from a 60-cycle source of electromotive force. The mercury jet, impinging on properly arranged sectors, rectifies particular half waves to give a succession of three half waves of one polarity followed by three half waves of opposite polarity. However, by using an autotransformer with a displaced neutral or middle connection, as one terminal of the lower frequency circuit, the central wave of each set of three is given a greater amplitude, resulting in a 20-cycle waveform of purer sine shape.



NEW FORM OF FREQUENCY CONVERTER

Salt Lake City Wholesale Baker Installs Mammoth Electric Bake Oven

BY BAYARD W. MENDENHALL

So far as is known, the first brand of bread to be put on the market which will be extensively advertised as being baked electrically, has made its appearance in Salt Lake City. The New Vienna Baking Company of that city announced this new product during the recent convention of the National Association of Master Bakers, in session in the Utah city. The company does an exclusive wholesale business, its entire product being sold through retail dealers.

The announcement made by Mr. Martinov, manager of the baking company, during the convention will do much to stimulate interest in electric bake ovens all over the United States. Full-page advertisements in the Salt Lake City newspapers while the bakers' convention was in session attracted much attention, and practically every baker in attendance at one time or another visited this new installation. Mr. Martinov has a thoroughly modern bakery throughout, including individually motor-driven mixers, dividers, rounders and electrically heated wrapping and sealing machines. When the new "Butter-Krust" bread was announced during convention week, it sprang into instant popularity. The afternoon that the writer visited the bakery they were so completely sold out of the electric-baked bread that it was difficult to find even a sample.

The electric oven used is one of the largest ever installed, and is the Hughes standard type No. 415. The main body of the oven measures 4 ft. high, 10 ft. wide and 12 ft. deep. It rests on an angle-iron frame 27 in. high. It is divided into four chambers each 56 in. by 34 in., by 16 in. high, which provides a baking surface of 208 sq. ft. The oven has a capacity of 836 12-oz. loaves or 456 25-oz. loaves of bread. The oven is divided in the center by a partition with two baking compartments on each side, one above the other. All compartments have 1¾-in. tile floors. The customary steam connection is provided for each. Each half of the oven has three heating units: One in the top of the upper

THE 75-KW. ELECTRIC OVEN IN USE IN SALT LAKE CITY BAKERY

compartment, one in the top of the lower compartment, and one directly under the floor of the bottom compartment. With this arrangement, heat is provided for the top and bottom of each baking chamber. Each compartment has a mercury thermometer and inside lights.

The heating units are made up of resistance wire wound on insulated rods. These rods are mounted in an angle-iron frame, which may be slipped in and out of the oven for inspection and repairs. Each unit is divided into three sections, and each section has three heats controlled by "three-heat" switches, which are located near the center of the oven in front and within easy reach of the operator.

The oven is wired for 220-volt, two-phase, service. It takes a maximum of 75 kw. and averages 48 per cent

Butter-Krust
Bread
Baked Electrically

With the completion of the new Vienna Bakery, which has just been rebuilt by Mr. M. Martinov, we are offering to the public today BUTTER-KRUST, the finest loaf of bread it is possible to produce.

Mr. Martinov has not stopped at installing the most modern machinery, such as high-speed mixers, dividers, rounders, moulders, etc., but has gone even further and installed a Hughes Electric Bake Oven—the only one of its kind in existence.

Many of the delegates at the convention of the National Association of the Master Bakers, which is now in session at the Hotel Utah, have visited the New Vienna Bakery to witness this new marvel of baking industry, and all have expressed their amazement at the difference between BUTTER-KRUST, which is baked electrically, and ordinary bread baked by the old methods.

Their verdict speaks volumes, but it is YOU—THE HOUSEWIFE—whom we want to im-

PART OF FULL-PAGE ADVERTISEMENT IN SALT LAKE CITY PAPERS ANNOUNCING ELECTRICALLY BAKED BREAD

of this demand baking sixteen hours per day and 55 per cent on eight hours' baking per day. When making ¾-lb. loaves it requires forty-five minutes to load the oven, bake the bread and take out the finished product. On this schedule 25,000 ¾-lb. loaves could be baked in twenty-four hours' continuous baking.

One great advantage of the electric oven lies in the fact that it is possible to maintain practically a uniform temperature through the entire period of baking, whereas with the old brick oven the temperature gradually reduces and the time for baking is extended, making it difficult to produce a uniform product.

A talk with the manager and with the head baker brought out the fact that both are very enthusiastic over electric baking. While they state that the bare cost for electricity is some higher than the cost of coal, they point out that when one considers the many advantages of the electric oven, not the least of which is the entire absence of the dirt, dust, and smoke which inevitably go with the old brick oven, and the saving in space, the higher cost for fuel is much more than offset.

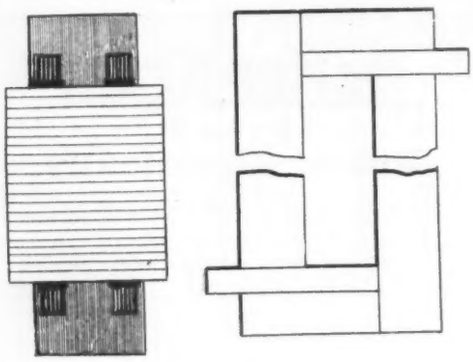
While it is a little too early to say so definitely, it is believed by them that the value of the "baked electrically" feature of their product for advertising purposes will also go far to offset the somewhat increased cost of operation.

Cannot Bring Suit Against Ontario Hydroelectric Commission

Hon. I. B. Lucas, attorney-general for the Province of Ontario, announced last week that he had rejected the application of the Electrical Development Company of Ontario (which has a large generating plant at Niagara Falls, Ontario), for a fiat permitting that company to bring an action in the Ontario courts to test the right of the Hydroelectric Commission to proceed with its proposed construction of a publicly owned generating plant by diverting the water from Chippewa Creek above Niagara Falls. It was also announced that the Province of Ontario would oppose any application to the Dominion government at Ottawa for the disallowance of the legislation passed by the Ontario Legislature at the last session.

Supports for Transformer Coils

A method for providing supports for the coils of core-type transformers is disclosed in a patent (No. 1,190,-481) to George W. Terhorst, assigned to the Pittsburgh Transformer Company. By providing part of the iron core with laminæ, built up of strips differing slightly in length, projections are provided which afford a resting



PROJECTIONS FORM SUPPORTS FOR COILS

ledge for the transformer coils. In fact, by reversing the arrangement of the laminæ the coils can be locked in place, if so desired, so that a very neat and mechanical appearance is given to the transformer.

Public Service Commission News

New York Commissions

Volume III of the eighth annual report of the Public Service Commission for the Second District, containing abstracts of reports of electrical, gas, telegraph, telephone and steam public service corporations, has recently been issued.

A manufacturing corporation cannot do business as an electrical corporation, according to the opinion of the Public Service Commission, Second District, which has therefore been compelled to refuse its approval of a franchise for an electric plant and distribution lines granted to the Brooklyn Cooperage Company by the town of Saulisbury, Herkimer County. The company's business is manufacturing and selling barrels and everything incidental thereto. The attorney-general has recently held that a corporation organized under this law is without power to carry on an electric lighting business, unless it has that specific power under its charter.

Energy to run a generator of a consumer for the purpose of manufacturing his own power for lighting purposes, must be furnished at the same rate as that charged for energy to operate motors, according to a decision by the Public Service Commission for the First District ordering the New York Edison Company to supply service to the Vandeau Amusement Company. The lighting company wanted to charge the amusement company for energy at the rate charged for illuminating purposes, because the amusement company used the energy purchased by it to operate a generator for supplying energy for lighting its theater.

Wisconsin Commission

In an investigation of the rates of the Milwaukee Electric Railway & Light Company the Railroad Commission gave answer to the question of reasonableness of classifying lighting customers between those taking residence and those taking commercial service. The commission said:

"Several characteristics go to justify a distinction between a residence and a business consumer. The residence consumer is a short hour user of his installation, while the business consumer is usually a longer hour user. The residence maximum demand on the station usually asserts itself at a later period than does the commercial maximum demand on the station. The residence consumer is usually at a greater distance from the central station than is the commercial customer. The investment per unit of sales is greater in the residence section of a community than it is in the business section.

"All of these matters mark distinctions between residence and commercial service. This commission has in numerous decisions subscribed to the so-called demand system of rate making. This form of lighting schedule automatically classifies consumers according to hours use of their active load. In the determination of the active load, too, this commission has differentiated between several class of consumers, and has applied different percentages to the installations of the several classes.

In each case the resident consumer falls into a more or less definitely defined "area" of average rates. Other classes of consumers will have lower or higher average rates in the practical application of such a schedule. A schedule of rates uniformly applied may still permit of rate differentials. So we are obliged to affirm the reasonableness of a classification which distinguishes residence from commercial service."

In a recent case brought against the West Allis Gas Company the commission was brought face to face with the problem of rates commensurate with the distance of supply.

"Legally," the commission stated, "there is no objection to basing a rate schedule upon distance differentials which will take care of the accumulating costs created by serving consumers at increasing distances. This form of schedule when applied to different distances within any city is objectionable, however, from a social point of view in that it discriminates in favor of the central portion of the city which tends to become congested at the expense of those districts that are farther removed.

It is also objectionable from an operating standpoint in that it might interfere with good engineering practice relating to the location of gas plants. Franchises have therefore usually required that a uniform rate apply to all sections within which the utility is authorized to operate. This has been the case in Milwaukee. But as between two municipalities, these arguments do not apply and for this reason the West Allis rate schedule must be based upon its separate cost data."

The fact that at the division line between West Milwaukee and West Allis, those consumers living on the West Milwaukee side of the street pay the Milwaukee city rate, while those consumers living across the road in West Allis pay the higher West Allis rate was felt to be a particularly objectionable example of the practical effect of the conditions complained of by the West Allis customers.

"This is, no doubt, a natural tendency," the decision went on to say "when the dividing line is so sharply drawn, but, on the other hand, it must be remembered that such a division must ultimately be made, and that if it were deemed unjust to separate West Allis from Milwaukee in the matter of rates, it would have to be held unjust to separate West Allis from its outlying neighbor at some future date. In this manner, the rule would necessarily have to be applied to successive extensions of the rate zone until the cost to the company became so great that an increase in all rates would be necessary."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Minors Cannot Be Employed for Testing Meters. — An order has been issued by the Pennsylvania State Industrial Board of the Department of Labor and Industry denying the right of electric companies to employ boys under eighteen years of age for testing electric meters.

Housekeepers to Force Day Service. —The North Shore Light & Power Company of Ilwaco, Wash., is considering the installation of a short electric day service to give electricity to housekeepers for use of irons and household equipment. The proposition is the result of agitation among the residents of the city.

Does Not Want City Business.—The Northern Ohio Traction & Light Company has declined the invitation of Commissioner of Light W. E. Davis of Cleveland, Ohio, to make a proposition to furnish the city energy to be distributed over the lines of the municipal plant. Commissioner Davis has intimated that the city should be able to buy energy at the same rate that it is furnished the Cleveland Railway Company for the operation of its cars. It would then be sold at the municipal rate of 3 cents.

New Branch Electric Shop for Chicago.—The sixth electric shop of the Commonwealth Edison Company, Chicago, was opened for business on Aug. 21. This new branch store, which is known as the Broadway store, is located at 4523 Broadway, from which location it can attract the trade of the Wilson Avenue neighborhood center. The establishment of this sixth store is in line with the company's general policy of creating as many conveniently located distributing points or "accommodation stations" for its electrical goods as is practicable.

New England Central Station Increases Rates.—Consumers of electricity in Chester, Mass., have been notified by the Chester Electric Light Company that a new schedule of rates went into effect Aug. 1. Instead of the rate of 20 cents per kw.-hr. charged formerly the rate is now 25 cents, and where heretofore a cash discount of 10 per cent was allowed if the bill was paid on or before the 10th of the month, the discount hereafter will be 5 per cent. This increase, it is understood, has been made necessary owing to the increase in the cost of materials and the large advance in the cost of labor.

An Electrically-Heated Hotel for Rupert, Idaho.—F. N. Victor, manager of the Rupert Electric Company of Rupert, Idaho, advises that his company is figuring on heating a fifty-room hotel through an electric boiler and indirect radiation. Such an installation will have to be made to compete with coal, but owing to the elimination of a fireman, as well as upkeep on the equipment, Mr. Victor believes that no trouble will be encountered in securing this contract. A maximum demand of 300 kw. is being figured on. The electric heating of the high school of Rupert, Idaho, was recently described in these columns. Energy is bought cheaply from the Minidoka reclamation plant.

Fans to Keep Away Flies.—In southern California the electric fan is almost universally used by shopkeepers to keep flies from alighting on foodstuffs, counters, etc. A conference of New York city officials was held recently to discuss the fly problem in the city markets. As a result, orders were placed for the installation of a system of large electric fans in Washington Market to supplement the fans which many of the merchants already have on their counters. These have been found most effective in combating the fly pest. The fans are so placed on the walls as to sweep the counters with cross-currents. Washington Market is one of the largest markets in the country, and owing to the large floor space and volume of business, screening would offer no solution to the fly problem. An ultimatum has also been issued by the health authorities of Chicago to the fruit dealers in the city's downtown district. The dealers have been instructed to demobilize the armies of flies in their places at once, either by screening in the fruit or by installing electric fans to blow the flies away from it.

Smoke from Return Tubular Boilers. —In discussing the smoke problem before the Cleveland Engineering Society, Osborne Monnett said that about 90 per cent of the smoke is made from return tubular boilers. Approximately 90 per cent of all the boilers in use for power purposes are of that type, and to obtain smokeless combustion it is necessary to design a satisfactory hand-fired furnace. A double arch bridge wall furnace, with a setting using a high temperature zone back of the bridge wall and consisting of butterfly arches built in two stands, so that it can be put in at small expense, is said to be suitable for the purpose. The arch back of the bridge wall has a bulkhead above it, against which the gases must impinge. The theory is that when fired by the alternate method, the volatile matter that normally distills away from the coal passes through a red-hot fire zone, and, impinging against the hot firebrick wall, mixes with air admitted over the fire and produces a secondary combustion, due to the heated and rich hydro-carbon gases in combination with oxygen at high temperature. When these conditions are provided, smokeless combustion results. This, according to the author, also enables a saving of from 10 to 15 per cent, due to the cleaner heating surfaces and better evaporation. Mechanical stokers, of course, may also be installed to remedy smoke troubles.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

Indiana Electric Light Association.—The annual convention of this association will be held at the Anthony Hotel, Fort Wayne, Ind., on Sept. 12, 13 and 14.

Dallas Electric Club. — A sales demonstration, in charge of Hartwell Jolonick, commercial manager of the Texas Power & Light Company, was the feature of the weekly luncheon meeting of the Dallas (Tex.) Electric Club and Jovian League, held at the Southland Hotel on Aug. 18.

Arkansas Public Utility Operators. —The president of the Arkansas Association of Public Utility Operators, W. J. O'Brien, has appointed an executive committee made up as follows: C. J. Griffith, chairman, Little Rock; H. C. Couch, Arkadelphia; J. F. Christie, Jonesboro; S. E. Dillon, Hot Springs; S. C. Dowell, Walnut Ridge; B. C. Fowles, Pine Bluff; H. C. Hoagland, Fort Smith; A. E. Main, Mammoth Spring; J. A. Wells, Warren.

Telephone Pioneers to Meet. — The sixth annual meeting of the Telephone Pioneers of America will be held at Atlanta, Ga., on Oct. 19 and 20, with headquarters at the Georgian Terrace Hotel. The business meeting will be held in the morning of the nineteenth, papers will be presented in the afternoon, and in the evening the annual banquet will be given by the American Telephone & Telegraph Company, to which Pioneers and members of their immediate families are invited. On the following day the Southern Bell Telephone & Telegraph Company has invited those attending to participate in an automobile ride to the Druid Hill Golf Club, where a barbecue will be served, following which the visitors will be shown the points of interest in and around Atlanta.

Picnic of Chicago Electrical Interests. —In spite of adverse weather conditions, the annual electrical reunion and outing of the Chicago Electric Club, Jovian League, and all other electrical interests of the city, held Aug. 10, at Ravinia Park, was unusually successful. The attendance was only half the expected number, due to the showers in the morning and afternoon, but the 600 present found something of interest for every minute, as the contests and various events were run off as planned. Greatest excitement centered about the pushball contest between the electrical contractors and electrical inspectors, which was won by the former. Various guessing and athletic contests were also provided for the ladies, and, likewise, many events in which the children participated. Suitable and valuable first, second and third prizes, many of which were electrical, were given the winners of all contests.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

FIXTURE BUSINESS HAS GOOD NORMAL GROWTH

Slow Deliveries of Materials Force Manufacturers to Carry Large Stocks—Prompt Delivery to Dealers Maintained to Date

The fixture and chandelier industry is enjoying a healthy growth and is only slightly abnormal due to building operations being somewhat above the average. It is expected that the year's business will show a growth over last year variously estimated from 15 per cent to 30 per cent. The product is being sold at an average of 25 per cent increase in price to the dealer, while the costs of material at present to manufacturers have gone up from 25 per cent to 200 per cent on various raw materials, the present costs to the dealer being kept down by earlier low-priced purchases. In addition to this material cost increase, the labor cost has gone up about 10 per cent over last year and some difficulty has been had in securing sufficient men, although this condition is somewhat alleviated at present. Slow delivery of materials is forcing the manufacturers to carry the largest stocks they ever had, but by so doing they have been able to continue prompt deliveries to the dealers. One prominent company which maintains twenty-four hour service on an extensive line of made-up fixtures, has been able to continue this practice thus far, but with four-month deliveries on glassware and six and eight months on brass rods, sheets and tubes, there is possibility that this prompt delivery will not be possible later in the year; and dealers who do not buy ahead at all may experience some delay in receiving their orders. The chemicals used in plating fixtures are extremely hard to secure and due to this cause there has already been considerable delay. Fall and winter business is expected to drop off some, but the year will close as a good one in the industry.

TRADE IN UNDERGROUND CONDUIT DULL

A Prominent Conduit Engineer Points Out the Factors That Have Deterred Activity in This Class of Work

In spite of high prices and general prosperity, there are few spots in the electrical business that are not far ahead of previous years. Much of the trade in electrical material has been made necessary by the greatly increased load on central stations. Where there is no urgent need for new apparatus and supplies, of course, some lighting plants are holding back on purchases until better prices obtain. That such is the condition underlying the market for underground conduit and supplies, is borne out by a letter to the Electrical World from G. M. Gest, a prominent conduit engineer and contractor. Mr. Gest says in regard to underground conduit construction:

"Undoubtedly the scarcity of labor, with its attendant high prices, has deterred many from going ahead with this class of work. We know of many instances of work mapped out for this year which have been deferred until the price of labor is reduced.

"The high price of copper has also been a deterring feature, as you must know. The construction of munition plants has used certain energy which would ordinarily have been devoted to our line. However, underground construction is making vast progress. Few, if any, ever change to overhead after starting underground systems, and we anticipate great years as soon as conditions are normal again. This work has been simply held back, and when the present unfavorable conditions are removed, it will advance with considerable speed."

MINIATURE-LAMP SALES LARGE

Production Below Volume of Orders—Demand Large for Both Domestic and Export Consumption

With factories operating at full capacity and with the volume of orders far in excess of production the domestic miniature lamp trade is to-day in the most prosperous condition in its history. In the summer of 1914, prior to the outbreak of the European War, Holland, Germany and Austria dominated the American market so far as the volume of business was concerned. Imported miniature lamps then cost less than American made lamps. Imported miniature lamps could be had for around 4.5 cents each, while domestic lamps, after all discounts were allowed, cost an additional 1½ to 2 cents.

Nevertheless, quantities of American lamps were sold to the domestic trade, but almost always on a quality basis. For inexpensive flash lamps where price and not quality was of the first importance, the American lamps, of course, could not compete with the imported lamp. In the more expensive flash lamps, however, domestic bulbs were found.

Of course, when the supply from Europe stopped domestic buyers turned to the American manufacturers as the only dependable source of supply. Similarly, the markets of the world have now turned to the American manufacturer. Those countries that supplied the bulk of the lamp trade of the United States, England, France and the other great purchasers of lamps have not been in a position to ship nor in most cases even to manufacture the lamps.

One of the largest calls for miniature lamps came from the Entente Powers for war purposes. The men in the trenches are each supplied with electric flash-lanterns.

In the last two years the demand for miniature lamps has been broadened considerably. This is particularly true with regard to the supply for automobiles. Almost every machine turned out at the present time is equipped for electric light. The minimum number is four lamps for each car—two head lamps, one inside lamp and a tail lamp. For automobiles both gas filled and vacuum lamps are used. The gas filled lamps are used only for the headlights, where an intense white light is desired. It is estimated that between 35 and 40 per cent of the lamps used in automobile headlights are of the gas filled type. For the inside and tail lamps vacuum lamps are used.

The largest demand for miniature lamps, of course, is from the flash lamp trade. New forms of flash lamps, almost all fitting a definite need, are continually being placed on the market and in large quantities. Other uses to which miniature lamps are placed in appreciable quantities are for mine lamps, in which a very respectable business is being built up; for decoration purposes, particularly the candelabra for hotels; for eyes for electric toys; for surgical purposes and for gun sights. The Navy, it is understood, employs a large number for this purpose. The lamps are vacuum type units rated at 10 volts.

There has been no advance in prices although labor and materials now cost much more than formerly. Economies in production and in other ways have helped the manufacturers to hold down production costs.

Deliveries are delayed to a certain extent owing to the volume of business, but every effort is being made to increase production to a point where it is possible to adequately supply the market.

BUSINESS IN STORAGE BATTERIES SHOWS PHENOMENAL INCREASE

Present Plants of Electric Storage Battery Company Overtaxed, and the Edison Storage Battery Company Business Large

The present condition in the electric storage battery field is reflected in a statement issued by Vice-President John R. Williams of the Electric Storage Battery Company of Philadelphia as follows:

"We are doing more business and making more money to-day than at any time in our history. It may be and probably is indirectly due to the tide of prosperity arising from the munition business. All our business now is practically in the United States and our important contracts to-day are largely with the United States government. We have two extensions to the plant under construction, and are trying to complete them as rapidly as we can. The plant is growing every minute and its present area is overtaxed. We are making money and there is nothing in the speculative movement of the stock that I know of that can be attributed to the company's affairs or management. I have been so busy attending to the company's prosperity that I really do not know what the recent market fluctuations in the stock have been."

While no statement is made at this time by the Edison Storage Battery Company it is understood that the volume of business is large and growing rapidly.

BRASS SITUATION OFFERS PROBLEM

Shortage of Yellow Alloy a Grave Matter With Manufacturers of Plugs, Sockets, etc.

A serious situation is now facing all manufacturers of products using brass. Although present brass production is enormous it is not sufficient to adequately supply the existing market. Customers are now able to procure only amounts based on their purchases in 1913, 1914, and 1915. It is understood that they may purchase this year a quantity equal to the average of their purchase in the past three years, plus that portion of increased production in those years. Thus if a company's average brass purchase for 1913, 1914, and 1915 were 200,000 lb. it could purchase during 1916 but 200,000 lb. of brass, and if the brass manufacturer had increased the average output of the past three years by 10 per cent then the customer could demand an additional 20,000 lb.

While such a plan is admitted to be fair under the existing conditions the electrical manufacturer finds himself in a very unpleasant situation. The average of the years 1913, 1914 and 1915 in the electrical industry was low. Thus the fairness of the method of brass distribution is of little solace to the manufacturer, particularly when the volume of his orders is record breaking.

Such is the condition which electrical manufacturers now have to face and especially those of sockets and plugs and such devices where brass is used to a large extent. One New England manufacturer in particular is now running at about 65 per cent capacity, while he has orders sufficient to carry his works at full capacity well into 1917.

BRITISH ELECTRICAL IMPORTS

United States in 1915 Takes the Place Formerly Occupied by Germany

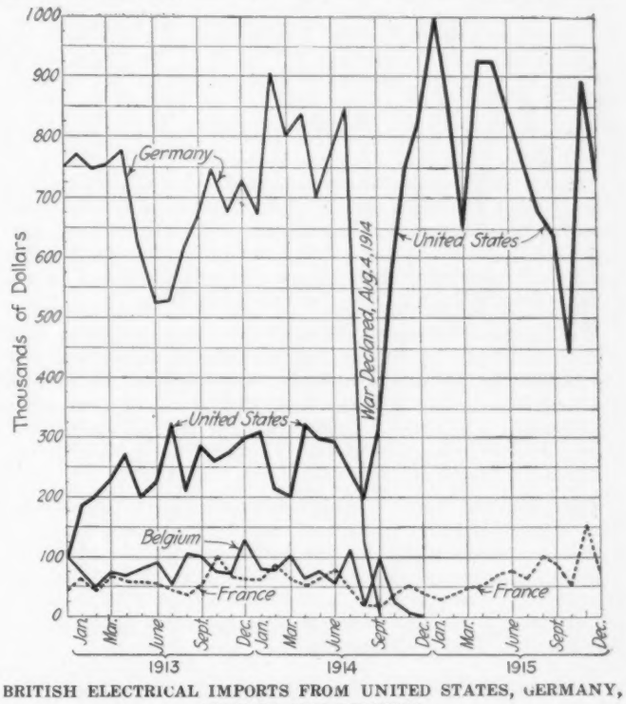
During 1915 there was imported into Great Britain electrical material to the value of $13,250,000 as compared with $13,850,000 in 1914 and $14,750,000 in 1913, according to a compilation made by the *Electrical Review* of London. Although the need for electrical goods continued after the war's start owing to large increases in the manufacture of munitions on the one hand and of the taking up of munition manufacture by the electrical factories on the other, the total imports showed a falling off. This was probably due to the inability of shippers to obtain bottoms of sufficient capacity and number.

Prior to the outbreak of the war considerably over half of the British electrical imports were of German origin. Early in 1914 a high level for German goods was reached when the imports from that country in one month amounted to around $900,000. Five months later war was declared and German goods no longer entered British ports.

Almost as soon as the war had snuffed out German trade with Great Britain the volume of American electrical goods entering Great Britain began to increase rapidly. In five months' time the monthly value of American electrical goods entering the British markets had increased from around $200,000 to approximately $1,000,000. Thus the United States, while not supplying the entire trade formerly supplied by Germany in a few months had assumed a very large portion of that business.

In 1913 the value of electrical goods imported into Great Britain from the United States was approximately $3,000,000, in 1914, $4,500,000, and in 1915, $9,275,000. The German figures during these years are $8,150,000 in 1913, $5,660,000 in 1914 and zero in 1915.

While the monthly totals are always subject to wide variations the greatest variations took place in the figures for the 1915 imports from the United States, as will be seen in the accompanying curves. One month the total was almost $1,000,000, and five months later was slightly more



BRITISH ELECTRICAL IMPORTS FROM UNITED STATES, GERMANY, FRANCE AND BELGIUM

than $400,000, while the figures for the next month were almost $900,000.

Apart from the United States and Germany the imports from France, Sweden, Norway, Denmark, Holland and Switzerland were greater in 1915 than in 1914. The French 1915 total was $835,000 as compared with $610,000 in 1915. The imports from France took a considerable slump at the outbreak of the war, but toward the end of 1915 had apparently thoroughly recovered. Sweden, Norway and Denmark together exported to Great Britain in 1915 electrical goods valued at $900,000 as compared with a little over $800,000 in 1914. Imports from Holland reached a total of $750,000 in 1915, an increase during the year of $450,000. Switzerland's 1915 total was the same as that for Holland and was over $300,000 greater than the 1914 total. A noticeable point about the Dutch imports was that they were four-fifths lamps. In other words, during 1915 Great Britain was buying $50,000 worth of lamps a month from Holland as compared with around $7,000 worth a month previous to the war.

Belgium, which previous to the declaration of war, enjoyed an appreciable trade with Great Britain, upon the invasion of its territory by the Teutonic armies was no longer able to carry on this foreign trade.

Manufacturing and Industrial

The Enterprise Electrical Company of New York has recently established an office at Mobile, Ala., which will be in charge of H. B. Unger.

H. B. Lucas.—The business, stock, plant, etc., of the Rodgers Electrical Company, Owensboro, Ky., has been acquired by H. B. Lucas, who will continue the business.

The Brown Instrument Company, Philadelphia, Pa., will open an office in Detroit on Sept. 1 which will be in charge of William Printz, formerly assistant sales manager, whose headquarters will be at Rooms 612 and 613 Chamber of Commerce Building.

The American Machinery Exchange, 217 Centre Street, New York, has recently been formed to deal in electric motors and generators and do electric construction work. M. M. Rafkin is president and F. H. Bang secretary and treasurer and A. E. Shadur, vice-president.

S. H. Stover, 518 Empire Building, Pittsburgh, Pa., who started in the manufacturers' agency business July 1, is now representing the following concerns: The W. A. Bonnell Company, New York; the Sterling Switchboard Company, Camden, N. J.; the Dielectric Manufacturing Company of St. Louis.

The Moore Steam Turbine Corporation, Wellsville, N. Y., which was recently formed, as noted in the ELECTRICAL WORLD of Aug. 19, has let a contract for a new modern brick and steel factory building, 90 ft. by 140 ft., and a power plant, and has ordered a complete assortment of machine tools.

"Delco-Light" Sales Convention.—A "Delco-Light" salesmen's convention was recently held at the Engineers' Club, Dayton, Ohio, under the auspices of the Domestic Engineering Company of Dayton. After the convention terminated about 100 members of the sales and service forces of the company attended a banquet at the Hotel Miami.

The Permutit Company, 30 East Forty-second Street, New York, dealer in water purifying compounds, announces that the following words have been registered in the United States Patent Office in connection with its trademark name "Permutit": "Permutize," Serial No. 93,944; "Permutized," Serial No. 93,942; "Zerowater," Serial No. 93,945; "Zerohardness," Serial No. 93,943.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., reports that on account of steadily increasing business in the East it has had to lease a larger suite of offices in New York. The new offices are on the nineteenth floor of the Hudson Terminal Building, 50 Church Street, the space being nearly double that previously occupied. W. C. Stevens is manager of this office.

Sales Convention of Anderson Car Company.—The Anderson Electric Car Company, makers of the "Detroit Electric" automobile, held a three-day convention at its factory, Aug. 21-24, for its dealers and salesmen. About 250 men attended the convention, at which G. D. Fairgrieve, sales manager, reported that the past twelve months have been the most prosperous ever experienced by the company.

The Kandem Electric Company, 29 East Twenty-first Street, New York, is now representing the Menominee Electric Manufacturing Company of Menominee, Mich., as exclusive agent in the following states: New York, New Jersey, Delaware, Rhode Island, Vermont, New Hampshire, Connecticut, Maine, Massachusetts and Pennsylvania. The Menominee company is manufacturing various types of wireless-telegraph instruments, bells, fans, motors and medical and telephone apparatus.

X-Ray Outfits for U. S. Army.—The Campbell Electric Company of Lynn, Mass., has supplied X-Ray outfits to the United States Army on the Mexican border for camp hospitals located at the following places: Brownsville, McAllen, Eagle Pass, Laredo in Texas, at Douglas and Nogales, Arizona, and Deming, New Mexico. In addition the company has also fitted out the industrial plant hospitals of the United Shoe Machine Company, Beverly, Mass., and of the General Electric Company at Lynn, Mass., with X-Ray units.

Charles M. Terry, Inc., Dalton House, 115 Pitt Street, Sydney, Australia, has secured the services of C. M. Barron, who will act as consulting and purchasing engineer with offices at 23 and 25 Beaver Street, New York. Mr. Barron has for the past five years been studying and cultivating the Australasian market for railway supplies, machine tools and raw materials and will endeavor to create a demand in Australia for American products.

Hughes Company's New Plant.—As was noted in the ELECTRICAL WORLD of July 15, 1916, the Hughes Electric Heating Company will build a new $150,000 factory at Waller Avenue and Taylor Street, Chicago, Ill. Ground will soon be broken for the erection of the first unit of the plant which will be designed by C. A. Erkstrom, architect. The building will be one story high, will contain approximately 80,000 sq. ft. of floor space and will give employment to 350 people. It will contain in addition to other conveniences, a restaurant for employees and a private dining-room for the officers of the company, all the cooking to be done exclusively with electric equipment.

The Squire Electric & Construction Company has moved into new quarters at 401 Wyandotte Street, Kansas City, Mo., where it has about 4000 sq. ft. of floor space, mostly devoted to a shop with concrete floor. The basement is partly occupied by the McCreary Plating & Enameling Company, a firm which Mr. Squire established eight years ago. A 40-hp. gas engine, using gas from the city mains, operates machinery, a dynamo and electroplating equipment. The establishment is also supplied with central station energy. W. J. Squire, president of the company, said that he would probably concentrate on repairs and open order contracts. He has now several large contracts which will require his personal attention during the summer.

U. S. Exports Electric Ranges All Over the World.—Few people probably realize the extent of the use of electric ranges. The growth of the industry has been remarkable, and with 2900 of the 3400 central stations in the United States giving a cooking rate, according to compilations made by the Hughes Electric Heating Company of Chicago, the future growth, it is felt, is sure to be repaid. But extensive use of the most modern means of cooking is not so surprising in the United States as is the fact that electric ranges have been ordered from American manufacturers in quantities ranging from one to 500 for countries all over the world, and even China recently put in a substantial order. The Hughes company reports export of electric ranges as follows: Colombia, Brazil, Argentine, Venezuela, Ecuador, Chile, Bolivia, Uruguay, Guiana, Costa Rica, New Zealand, Jamaica, Guatemala, San Salvador, Panama, Mexico, Canada, East Indies, West Indies, Philippine Islands, Australia, Holland, Sweden, Norway, Italy, Spain, Portugal, England, Alaska, Switzerland, South Africa, China and India.

Electric-Vehicle Tests and Electric Welding Features of New York Electrical Exposition.—Electric vehicles of both the pleasure and commercial types, as well as various kinds of accessories, will hold a prominent place, it is reported, in the New York Electrical Exposition of 1916, which will be held in the Grand Central Palace, Oct. 11-21. As in the past, the automobile side of the exposition will represent all the latest developments and improvements. A test run of unusual interest is now being planned to be held during the exposition. Among the exhibits will be one maintained by the Electric Garage of Central Park West and Sixty-second Street, which will be representative of the work it is carrying on. Included in the latest types of pleasure vehicles to be shown will be various types of Baker, R. & L. and Detroit cars. Among the exhibitors of commercial cars will be the General Vehicle Company, the Walker Vehicle Company and the Ward Motor Vehicle Company. The Edison Storage Battery Company and the Electric Storage Battery Company will also have exhibits. Another feature of the exposition will be the demonstration of electric welding of iron and steel arranged by the Arc Welding Machine Company with O. A. Kenyon in charge. The United States government is co-operating with the exposition authorities and comprehensive exhibits representative of electrical work done by the war, navy and commerce departments will be shown.

The Liebel Manufacturing Company.—G. H. Liebel has resigned his position as manager of the Cincinnati office of the Robbins & Myers Company to become president and treasurer of the Liebel Manufacturing Company of Cincinnati, maker of x-ray apparatus.

Testing Cloth Colors by Artificial Light.—The Joseph & Feiss Co., Cleveland, Ohio, manufacturer of men's clothing, has developed a method for testing colors in cloth that bids fair to come into general use, it is declared. The apparatus utilized consists of a 28-amp. "Aristo" arc lamp, marketed by the Western Electric Company, with a white-flame carbon electrode on the positive side and a 0.5-in. No. 415 "Columbia" carbon electrode on the negative. The lamp is suspended from the ceiling and surrounded with a rack of wire netting about 20 in. in diameter. The samples of cloth to be tested are suspended from this rack. Half of each sample is covered, so that the light has no affect on it and comparisons may, therefore, be made as desired. The rack is surrounded with an asbestos protector and an asbestos protector is also placed underneath as a protection from fire. It was found that a fifty-hour exposure of cloth to the light produced an effect equal to that of an exposure of nineteen days' under a Florida sun in February. The southern sun is perhaps more severe than in the more northerly sections of the country and it is believed that an exposure of thirty or forty hours would be sufficient for comparison with the sun's effects in the North.

To Find Markets for American Electrical Goods.—R. A. Lundquist, consulting engineer of Minneapolis, has been selected by the Bureau of Foreign and Domestic Commerce to study the markets for electrical goods in China, India, Australia, South Africa and a number of other countries in the Far East. There was a time when American electrical goods met with considerable competition in the Far East, but the war has greatly handicapped the principal European competitors, and American manufacturers are making a serious effort, the Bureau states, to take advantage of the situation and get permanent possession of the markets. A great deal of preliminary study is still needed and Special Agent Lundquist's part in the campaign will be to ascertain the types, qualities and costs of electrical apparatus with which American goods come into competition, as well as to look into the general opportunities for the sale of such goods. Before leaving on the trip the special agent will spend some weeks in the principal business and manufacturing centers conferring with manufacturers, exporters, and business houses on the scope of the investigation. Mr. Lundquist was graduated from the University of Minnesota in 1905 with the degree of electrical engineer, following which he put in six years with prominent electrical houses. Since 1911 he has been in business for himself in Minneapolis, specializing in hydroelectric and transmission-line work. He is the author of "Transmission Line Construction —Methods and Costs," and has contributed numerous articles to the technical press. He is chairman of the Minnesota section of the American Institute of Electrical Engineers.

NEW YORK METAL MARKET PRICES

	Aug. 15 Selling Prices Bid	Aug. 15 Selling Prices Asked	Aug. 22 Selling Prices Bid	Aug. 22 Selling Prices Asked
Copper	£ s d		£ s d	
London, standard spot	114 0 0		110 10 0	
Prime Lake	26.25	to 26.75†	27.00	to 27.50†
Electrolytic	27.00	to 27.25†	27.75	to 28.00†
Casting	24.37½	to 24.62½†	24.87½	to 25.12½†
Copper wire	31.00†		32.50†	
Lead	6.00		6.50	
Nickel	45.00	to 50.00	45.00	to 50.00
Sheet zinc, f.o.b. smelter	15.00†		15.00†	
Spelter	9.17½	to 9.42½	9.67½	to 9.92½
Tin, straits	39.00		38.45	
Aluminum, 98 to 99 per cent	56.00	to 58.00†	56.00	to 58.00†

OLD METALS

Heavy copper and wire	21.00 to 21.50†	21.50 to 22.00†
Brass, heavy	12.50 to 12.75†	12.75 to 13.00†
Brass, light	9.00 to 9.50†	9.50 to 10.00†
Lead, heavy	5.00 to 5.12½†	5.50 to 5.62½†
Zinc, scrap	6.00 to 6.25†	6.25 to 6.50†

COPPER EXPORTS

Total tons to Aug. 22 22,544

†Nominal.

Corporate and Financial

Northern Ohio Traction & Light Company, Akron, Ohio.—The proposed sale of a controlling interest in the common stock of the company to Eastern interests was not formally discussed at the meeting of the stockholders of the company in Akron on Aug. 15, but a definite decision is expected at an adjourned meeting, called for Sept. 5. It is understood that representatives of the Eastern interests had not completed their appraisal of the property when the meeting was held. Hodenpyl, Hardy & Company, New York, and E. W. Clark & Company, Philadelphia, are reported to be interested in the proposed deal. The sale, if it goes through, it is understood will be at par, minority stockholders being permitted to sell at the same figure. It was at first reported that the system would be merged with the Republic Railway & Light Company, but this report officials of the Akron company deny. The stockholders approved the plans of the directors for the creation of a first lien and refunding bond issue of $14,075,000. Of this sum $4,000,000 is already under an agreement of sale.

Orange & Rockland Electric Company, Monroe, N. Y.—The issue of $37,000 par value of 5 per cent, first and refunding mortgage bonds at 90, to net $33,300, or in their place or in the place of any part of them, $33,000 of 7 per cent cumulative preferred stock at par, has been authorized by the Public Service Commission for the Second District of New York. The proceeds will be used to reimburse the treasury of the company for expenditures from income made for capital purposes during 1913 and 1914. The company is also authorized to issue $25,000 of its 7 per cent cumulative preferred stock at par to provide for estimated extensions and improvements of its lines during 1916 and 1917. A further order of the commission permits the company to issue this preferred stock instead of bonds authorized but unsold some years ago for the purpose of financing liabilities outstanding on Dec. 31, 1912.

Public Service Company of Northern Illinois, Chicago, Ill.—In a 28-page illustrated booklet which has been issued by the company information is published regarding the territory served by the company, the growth in its load, its financial standing, the increases in numbers of customers and stockholders, its electric service system, its gas service, its heat and water supply, its system of operation, its welfare work, industrial applications of electricity sold and the company's personnel. A map of the territory served is also given.

Sheboygan (Wis.) Railway & Electric Company.—Announcement has been made of the purchase of the property of the company by Kelsey, Brewer & Company, representing the American Public Utilities Company of Grand Rapids, Mich. In purchasing the plant of the Sheboygan company, which includes the street railway line, electric light and power plant in Sheboygan to Sheboygan Falls, Plymouth and Elkhart Lake, it is understood, Kelsey, Brewer & Company will not increase the present capital of the plant, which is $600,000, but will issue $1,500,000 of bonds which will replace all outstanding bonds of the old company.

Southern New York Power Company, Walton, N. Y.—The company has been authorized by the Public Service Commission for the Second District of New York to issue $16,000 of its common stock at par to reimburse the treasury for moneys expended for capital purposes and to discharge unfunded debt of $1,457 outstanding at the first of the year.

New Utility and Industrial Companies

The Davidson Electric Company of Corsicana, Tex., has been incorporated with a capital stock of $2,500 by C. G. Davidson, M. C. Caston and J. W. McGill.

The Minnesota Power Company of Augusta, Me., has been organized with a capital stock of $2,000,000 to conduct a general contracting and construction business and to own, deal in or operate any kinds of public works and conveniences. The officers are: R. S. Buzzell, president; L. J. Coleman, treasurer, and C. L. Andrews, clerk, all of Augusta, Me.

The Crescent Electric Corporation of Newport News, Va., has been incorporated with a capital stock of $15,000. The officers are: T. G. Gray, president; T. A. Fowler, vice-president, and A. P. Ransom, secretary and treasurer.

The Perfectolyte Company of St. Louis, Mo., has been granted a charter with a capital stock of $50,000 for the purpose of doing a lighting fixture business. The incorporators are: Frank Adam, Harry C. Adam and C. J. Bente.

The Citizens' Utility & Development of Fort Pierce, Fla., has been incorporated with a capital stock of $50,000. The officers are: W. H. Towles, president; G. F. Ireland, vice-president; Albert G. Colcord, secretary, and T. P. Gay, treasurer.

The Trenton Electric Supply Company of New Brunswick, N. J., has filed articles of incorporation with the Secretary of State. The company is capitalized at $50,000 and proposes to manufacture electric motors, dynamos, machinery, supplies, etc.

The Knittle Cashel Company of San Francisco, Cal., has been incorporated by J. L. Knittle, William D. Cashel and F. Ammann. The company is capitalized at $10,000 and proposes to construct and install heating, ventilating and power plants.

Duzets & Son, Inc., of New York, N. Y., has filed articles of incorporation with a capital stock of $50,000 to manufacture electrical machinery and appliances. The incorporators are: J. Duzets, F. A. Duzets, 1019 Trinity Avenue, and L. J. Davidson, 1125 Boston Road, New York, N. Y.

Reico, Inc., of Hoboken, N. J., has filed articles of incorporation with the Secretary of State. The company is capitalized at $10,000 and proposes to deal in electric incandescent lamps. The incorporators are: J. C. Jackson, J. J. and F. J. Rooney, Fourteenth Street and Park Avenue, Hoboken, N. J.

The Fleer Electric & Manufacturing Company has filed articles of incorporation under the laws of the State of Delaware to deal in and with dynamos and electrical machinery. The company is capitalized at $100,000. The incorporators are: George V. Reilly, L. H. Gunther and Samuel B. Howard, all of New York, N. Y.

The Steffen Electric Company has been granted a charter to operate in White Township, Beaver County. The company is capitalized at $5,000. The office of the company will be at Beaver Falls. The incorporators are: J. E. White and E. R. Baldringer of Pittsburgh, Pa.; J. D. Perrott, F. C. Perrott, W. S. Craig, T. M. Gilchrist of Beaver Falls, Pa.

The Multiune Carburetor Company has filed articles of incorporation under the laws of the State of Maine with a capital stock of $60,000. The company proposes to manufacture and deal in mechanical and electrical devices. The officers are: W. H. Coolidge, Jr., of Manchester, Mass., president, and H. P. Sweetser of Portland, Me., clerk and treasurer.

The Burdette Oxygen Company of Augusta, Me., has been incorporated with a capital stock of $300,000 for the purpose of manufacturing oxygen and hydrogen gases by means of patented electrolytic cells and generators, storage and sale of same; also the sale of appliances used in said manufacture. The officers are: E. M. Leavitt of Winthrop, Me., president and treasurer, and Ernest L. McLean of Augusta, clerk.

Trade Publications

Battery Cabinet.—W. R. Ostrander & Company, 371 Broadway, New York, have prepared an illustrated leaflet descriptive of their steel dry-battery cabinet.

Boiler-Compound Feeder.—An automatic boiler-compound feeder is described in a folder issued by the Taber Pump Company, 291 Elm Street, Buffalo, N. Y.

Taps.—The Greenfield Tap & Die Corporation, Greenfield, Mass., has recently published an attractively illustrated bulletin which contains information on its new "Gun" tap.

Soldering Paste.—The Burnley Battery & Manufacturing Company, North East, Pa., is sending out a leaflet printed in colors which contains information on a soldering paste that will not spill or corrode.

Electric Dishwasher.—The Domestic Utilities Company, 267 Mount Pleasant Avenue, Newark, N. J., has prepared a folder which describes and illustrates the "Nevernick, Jr.," electric household-type dishwashing machine.

Ornamental Lighting Fixtures.—The Luminous Unit Company, St. Louis, Mo., has prepared an illustrated leaflet which describes and illustrates several types of "Brascolite" semi-direct lighting fixtures for hotel lighting.

Wiring Devices.—The Crouse-Hinds Company, Syracuse, N. Y., has just brought out bulletin No. 1000-E which is a supplement to its catalog No. 1000, and bulletin No. 1000-B, illustrating and describing various types of "Condulets."

Switchboards and Cabinets.—Catalog No. 1, which is being sent out by the Portland Electric Maintenance Company, 121 North Fifth Street, Portland, Ore., describes and illustrates various types of switchboards, panelboards and steel cabinets.

Ornamental Fixtures. — Shapiro & Aronson, 20 Warren Street, New York, have published a catalog entitled, "Satisfactory Lighting Service," which contains information on several types of ornamental fixtures for direct and semi-direct lighting.

Ornamental-Lighting Fixtures for Nitrogen-Filled Lamps.—The Philadelphia Lighting Specialty Company, 1235 Filbert Street, Philadelphia, Pa., has issued a folder which describes and illustrates the "Eye Safety First" glass fixture designed especially for use with nitrogen-filled lamps.

Wiring Devices.—The Advance Electric Company, Leetonia, Ohio, has prepared a folder which is illustrated and contains information on the "Wayman" switch box supporter and spacer, type A adjustable outlet board, type B metal outlet board and an adjustable insulator support.

Dual Power Car.—The Woods Electric Vehicle Company of Chicago has issued a booklet descriptive of its gasoline electric car, which is a masterpiece of the printers' and engravers' art. The booklet is also very effective in its descriptions of the various parts and operating features of the car.

Indicating and Recording Thermometers.—The Foxboro Company, Foxboro, Mass., has published Bulletin No. 104, which is attractively illustrated and contains a large amount of information on and diagrams of various types of indicating and recording thermometers. The bulletin also contains specimens of charts.

Glass Lighting Fixtures.—Catalog No. 96, issued by the Macbeth-Evans Glass Company, Pittsburgh, Pa., is attractively illustrated and contains information on the "Ajax-O-Lite" for hospital lighting. It has also just brought out catalog No. 97, which describes and illustrates "Ajax-O-Lites" for commercial lighting.

Boiler Tube Cleaners.—Catalog L-9 issued by the Lagonda Manufacturing Company, Springfield, Ohio, is attractively illustrated and describes various types of boiler tube cleaners designed for removing various types of boiler scale from all sizes and types of tubes. The catalog also contains information on other Lagonda boiler-room specialties.

Meters, Switchboards and Lightning Arresters.—The General Electric Company, Schenectady, N. Y., has published bulletin No. 46201 on Type L-14 and IS-4 single-phase watt-hour meters; bulletin No. 46253 on Type D-6 and Type DS-6 polyphase watt-hour meters for house service and switchboard service respectively; bulletin No. 47100 on truck-type "safety first" switchboards and bulletin No. 45603 on graded shunt resistance multigap lightning arresters for use on alternating-current constant-potential circuits.

Electric Apparatus.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued leaflet No. 3811-A on installations of Westinghouse motors for main rolls of steel mills; leaflet No. 3561-A on transformers of the radiator tank type; leaflet No. 3780-A on magnetic controllers for alternating-current hoist equipments with ratings of 50 hp. to 500 hp.; leaflet No. 3516-A on machine-tool motor applications; leaflet No. 1101 on direct-current commutating-pole mill motors; leaflet No. 3917 on application of lightning arresters on direct-current street railway feeder lines and folder No. 4317 on factory sewing machine motors.

New England

AUGUSTA, ME.—The Central Maine Power Company of Augusta is erecting a transmission line to connect its main power plant with the Penobscot Bay Electric Company's plant in East Belfast, which is owned and controlled by the former company. The Central Maine company also contemplates the erection of a line from Bingham to Monson and one from Rockland to Waldboro.

VINAL HAVEN, ME.—The Public Utilities Commission has granted the Islands Electric Company permission to furnish service in Vinal Haven and North Haven; also to issue $25,000 in capital stock and $50,000 in bonds. Under the terms of the grant the Islands company is to acquire the plant of the Vinal Haven Electric Company.

MARLBORO, N. H.—The property of the Mariboro Light, Heat & Power Company has been purchased by the Ashuelot Gas & Electric Company of Keene, N. H.

GREAT BARRINGTON, MASS. — The Great Barrington Electric Light Company is contemplating extending its transmission lines to New Marlboro and Southfield. Next summer wires will be erected to Lake Buel.

NEWBURYPORT, MASS. — Negotiations have practically been closed whereby the Newburyport Gas & Electric Company will furnish energy to the Amesbury Gas & Electric Company, which supplies electrical service in Amesbury and Salisbury. The contract will become operative as soon as thee new power station is completed.

SALEM, MASS. — The Salem Electric Lighting Company has been granted permission to install conduits for wires in Chestnut, Flint and Essex Streets, and up Highland Avenue some 1400 ft. for its transmission line to Malden. The company has also been granted the right to lay conduits over the extension of Derby Street across the Fairfield Dock property and the Congress Street extension.

WESTFIELD, MASS.—The electric light company is erecting a 5-mile 6600-volt transmission line and is building a two-story warehouse and a 125-ft. stack. G. E. Mitchell is manager.

CENTRAL FALLS, R. I.—The contract for wiring a number of schools for electric lights has been awarded to Elsworth P. Baker of Pawtucket.

NEW LONDON, CONN.—Arrangements are being made by the New London Ship & Engine Company to install a new power plant, to supply electricity to operate its shop and foundry, supplementing the service of the Groton Borough plant. A concrete building, 65 ft. by 56 ft., one story high, will be erected, four 360-hp. Diesel engines will be installed. The engines will be built by the company. Westinghouse Church Kerr & Company, New York, N. Y., are construction engineers.

Middle Atlantic

BINGHAMTON, N. Y.—The Public Service Commission has granted the Binghamton Light, Heat & Power Company permission to issue $500,000 in bonds, the proceeds to be used for the erection of its new power house, etc.

COOPERSTOWN, N. Y.—The capital stock of the Colliers Light, Heat & Power Company of Cooperstown has been increased from $50,000 to $500,000. The company recently received authority from the Public Service Commission to extend its transmission lines into Otsego County.

DEPOSIT, N. Y.—The Public Service Commission has authorized the Deposit Electric Company to extend its service into the town of Tomkins in accordance with franchise granted by the town authorities.

ELIZABETHTOWN, N. Y.—The Elizabethtown Electric Light Company is changing its system from 125 cycles to 60 cycles. J. L. Webster is manager.

ITHACA, N. Y.—The Public Service Commission has approved the franchise granted the Ithaca Gas & Electric Corporation for extensions of its gas and electric lines into the towns of Ithaca and Lansing.

MONROE, N. Y.—The Public Service Commission has authorized the Orange & Rockland Electric Company of Monroe to issue $37,000 in bonds to be sold at 90, or $33,000 in capital stock, the proceeds to be used for refunding purposes. The company is also permitted to issue $25,000 in capital stock at par, to provide for estimated extensions and improvements of its lines during 1916 and 1917.

OLEAN, N. Y.—The Olean Electric Light & Power Company is installing an additional 1500-kw. 60-cycle, 2300-volt generator.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

RANSOMEVILLE, N. Y. — The Town Board has granted the Lewiston & Lake Ontario Shore Power Company a franchise to construct an electric lighting system in Ransomeville.

UNION SPRINGS, N. Y.—Improvements are contemplated to the plant and system of the Union Springs Light & Power Company, including the installation of surface condensers, water pumping system for boilers and smoke consumers. The company is erecting a transmission line into the country, a distance of about 3 miles, and is planning to repair its existing lines. Douglas A. B. Smith is general manager.

CHESTER, PA.—The United Telephone & Telegraph Company has applied for permission to install a conduit along Edgmont Avenue.

CLAYSBURG, PA.—Notice has been given that the Standard Public Service Company will make application to the Public Service Commission for a certificate of public convenience to supply electricity for lamps, heater and motors in Greenfield Township and adjacent territory. The plant will be located in Claysburg. O. H. Hewitt is attorney.

HARRISBURG, PA.—Charters have been granted to the following associated light and power companies: The Cleveland Township Electric Company, the Rush Township Electric Company, the Franklin Township Electric Company, and the Newberry Township Electric Company. H. F. Baker of Germantown is treasurer.

MEADVILLE, PA.—Plans prepared by J. W. Yard & Son of Erie, for the erection of two new buildings at the Odd Fellows' Home at Meadville, to cost about $20,000, have been approved by the trustees of the Home Association. One of the new buildings will be used as a power house and laundry and the other as an isolated ward and quarters for help.

NEW CASTLE, PA.—The installation of a new street-lighting system on Long Avenue in Fifth and Eighth Wards is under consideration. Edward Brown is city clerk.

PHILADELPHIA, PA.—The contract for construction of new power station at the Reed Street yards of the Pennsylvania Railroad has been awarded to John N. Gill & Company of Philadelphia, Pa., at $20,074.

PHILADELPHIA, PA.—Bids will be received at the Depot of Supplies, United States Marine Corps, 1100 South Broad Street, Philadelphia, Pa., until Aug. 28, for furnishing one bolt heading machine, one electric blower, one electric bench grinder, two drill chucks, one set expanding mandrels, on chain hoist, one boiler tap, one flue cutter, etc. For further information address the depot quartermaster.

PHILADELPHIA, PA.—The contract for the construction of an eleven-story office building and power station, including tearing down of building now on the site at 20-22 South Fifteenth Street, Philadelphia (with the exception of the lighting fixtures and bank vault), for the Franklin Trust Company, has been awarded to Nickson-Duggan Construction Company, Bailey Building, Philadelphia. The power house is located on Hicks Street. The contract price is $300,000. DeArmond, Ashmead & Bickley are architects, and the Schofield Engineering Company, Commercial Trust Building, Philadelphia, are engineers.

TOPTON, PA.—The proposal to appropriate $23,000 will be submitted to the voters at the November election. If approved it will provide $9,000 for an electric-light plant, $7,000 to increase the municipal water supply and $7,000 for a new town hall.

BLOOMFIELD, N. J.—A $700,000 power plant is to be built for the Sprague Electrical Works, subsidiary of the General Electric Works at Watsessing, by John W. Ferguson, contractor. The building will be six stories, of reinforced concrete construction.

HOBOKEN, N. J.—The Pennsylvania Railroad Company is planning to build an addition to boiler room at its local shops.

ORANGE, N. J.—The Public Service Electric Corporation is contemplating improvements and extensions to its Lakeside Avenue power station.

VINELAND, N. J.—The Borough Commissioners have awarded the contract for extensions and improvements to the municipal electric-light plant to M. L. Bayard & Company of Philadelphia, Pa., at $93,000.

BALTIMORE, MD.—Plans have been prepared by Otto G. Simonson, Maryland Casualty Tower Building, Baltimore, for the construction of a hotel at Light and German Streets for the Southern Hotel Company, Calvert Building, for which bids will be received until Aug. 29. The building will be 92.6 ft. by 148 ft., 15 stories high. Three 150-hp. boilers will be required for steam heating plant and three generators, 100, 125 and 175 kw. for the electric generating plant. Three electric elevators and three lifts will be installed.

ALEXANDRIA, VA.—The City Council has accepted a contract with the Alexandria County Lighting Company for lighting the streets of the city for a period of ten years. Under the terms of the contract the company will furnish 86 additional lamps.

WASHINGTON, D. C.—Bids will be received by the Department of the Interior, Washington, D. C., until Oct. 4, for installing two electrically operated elevators in St. Elizabeth's Hospital, Washington, D. C., one each in the kitchen and in laundry in accordance with plans and specifications, of which copies may be obtained from E. J. Ayers, acting secretary.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations the following supplies: Pensacola, Fla., Schedule 39—Miscellaneous aeroplanes and power plants complete. Philadelphia, Pa., Schedule 33—One vertical tubular boiler; Schedule 35—12,000 lb. Muntz angle metal, 32,000 lb. Muntz metal plates. Boston, Mass., Schedule 35—Five ventilating fans; Schedule 25—17,400 lb. soft galvanized steel wire. Puget Sound, Wash., Schedule 37—Three power sewing machines. Brooklyn, N. Y., Schedule 26—365 jack plugs for telephones, miscellaneous low-pressure brass gate and angle valves, 12,300 lb. soft commercial sheet brass. Washington, D. C., Schedule 28—miscellaneous transmitting radio sets; Schedule 22—Miscellaneous hot-rolled or forged carbon steel. Mare Island, Cal., Brooklyn, N. Y., Schedule 26, 31—Miscellaneous composition pipe fittings. Mare Island, Cal., Schedule 31—Eight ¾-in. steam traps, 300 lb. commercial hard sheet brass. Charleston, S. C., Schedule 26—Miscellaneous steel boiler tubes. Newport, R. I., Schedule 15—100,000 unannealed brass tubes. Norfolk, Va., Schedule 16—18,000 lb. sheet aluminum; Schedule 36—120,000 lb. medium steel plate. Applications for proposal blanks should designate the schedule desired by number.

North Central

BELDING, MICH.—The Spencer Electric Light & Power Company of Belding is building a new concrete dam to replace the old wooden dam which was washed out by the high water last spring. The company is also erecting 59 ornamental lamp posts, mounted with single lamps of 250 cp. each, for the city of Belding. Electricity for maintaining the lamps will be supplied by the company. J. E. Stanton is manager.

DETROIT, MICH.—Charles A. Gadd, secretary of the Board of Education, will receive bids until Sept. 12 in connection with a new twenty-three-room school, to be erected on Cicotte Avenue. Proposals will be received for the entire job and for separate classes of work. Malcomson & Higginbotham, 404 Moffat Building, have the plans and specifications.

GROSSE POINTE, MICH.—Installation of a $15,000 street lighting system in all of the main thoroughfares of Grosse Pointe Park village will begin by Sept. 1. The lamps will be of 1000 cp.

HIGHLAND, PARK.—Bids will be received by the Board of Education, Highland Park, Mich., until Sept. 21, for erection of a school building on the so-called, Northwestern School site. Bids may be submitted on the entire work or upon one or more parts or subdivisions thereof, according to plans and specifications on file at the office of Wells D. Butterfield, architect, David Whitney Building, Detroit, Mich. Caleb S. Pitkin, 137 Grand Avenue West, Highland Park, is secretary of board of education.

MORENCI, MICH.—The Southern Michigan Light & Power Company expects to change the generators at the steam plant from 133 to 60 cycles at once. C. J. Davis of Morenci is treasurer and manager.

CINCINNATI, OHIO.—Application has been made by the officials of the Cincinnati Sanitarium for a permit to build a one-story power house in the rear of the Cincinnati Sanitarium, College Hill.

CINCINNATI, OHIO.—The Union Gas & Electric Company of Cincinnati has submitted a proposal to the villages of Cleves, North Bend and Addyston, offering them about the same rate for service as is given to the people in Cincinnati.

COLUMBUS, OHIO.—Additions are contemplated to the municipal electric-light plant and bids are now being advertised for two 500-hp. boilers and auxiliaries and one 4000-kw. steam turbo-generator, with condensers, exciters, etc. H. E. Eichhorn is superintendent.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until Sept. 1, for furnishing an auto transformer for the division of light and heat.

ELYRIA, OHIO.—It is reported here that the Lorain County Electric Company, supplying Elyria, Lorain and some of the big industries, will double the capacity of its plant. Plans for extensions and enlargements call for the expenditure of about $250,000.

HAMILTON, OHIO.—A resolution has been adopted by the City Council for submitting a bond issue of $100,000 to a vote of the electors for the purpose of installing cluster lamps in the business section of the city.

LOCKLAND, OHIO.—The Council has passed an ordinance granting the Union Gas & Electric Company a fifteen-year franchise for street lighting. It provides an annual charge of $20.50 for each lamp of 80 cp. and $22 for lamps of 100 cp

LORAIN, OHIO.—$250,000 is to be expended by the Lorain Electric Company at its central power plant. The big power station on the lake front, which cost $150,000, and which has been enlarged to nearly double its original capacity, is to be doubled again by the installation of new boilers and additional 6250-kw. turbine-driven generator. The present smokestack, already one of the largest in the county, will be replaced with a stack towering 250 ft. above the ground.

MANSFIELD, OHIO.—Ground has been broken for the newer station of the Mansfield Railway, Light & Power Company. The initial installation will provide for a generating capacity of 7000 kw. and transmission lines will be erected to Mansfield and Ashland.

OXFORD, OHIO.—The Richmond (Ind.) Light, Heat & Power Company has submitted a new proposition to the town of Oxford offering to furnish electricity to operate the municipal electric-light system at 2.4 cents per kw-hr., provided the town will erect lines to College Corner. The town officials are considering increasing the output of the municipal electric plant.

TOLEDO, OHIO.—The electric heating department of the Toledo Railway & Light Company is at present installing in two plants of the Auto Lite Company of Toledo four continuous baking ovens. The installation will cost about $30,000 and will mean an additional load of 900 kw. for the Toledo Company.

COVINGTON, KY.—Weber, Werner & Adkins, Cincinnati, have plans and specifications for the new Covington high school, bids for the construction of which will be received until 1 o'clock on Sept. 11, by the Covington board of education. Information concerning the building may be had of the architects or the board.

FLEMINGSBURG, KY.—The Flemingsburg Light & Ice Company will issue an additional $8,000 of stock, authorized, and install alternating equipment in its electric power plant.

HAZARD, KY.—The Kentucky River Power Company is constructing a steam turbine central station in Hazard. The equipment will include two 1800-kw. turbogerneators (Westinghouse Parsons type), jet condensers, two 500-hp. Stirling boilers, Westinghouse stokers, steel bunker conveyor from coal company's tipple to bunker over boiler room. Energy is generated at 2300 volts, stepped up to 33,000 volts for transmission. Building and at present erected 30 miles of transmission lines; ten outdoor transformer stations. The company supplies electricity to 16 coal operations in the Hazard field. R. L. Cornell is general manager.

LEXINGTON, KY.—A new street lighting system is to be provided for in connection with the new franchise purchased by the Lexington Utilities Company.

LOUISVILLE, KY.—The Lexington Utilities Company has purchased the 20-year franchise prepared for the city of Lexington by the Utilities Bureau of Philadelphia, at the upset price of $20,000. The new franchise becomes effective Nov. 1 and involves a reduction in rates and also provides for a revision of rates every four years.

OWENSBORO, KY.—Plans are being considered for increasing the output of the municipal electric-light plant, at a cost from $20,000 to $30,000.

CARTHAGE, IND.—F. F. Brenan, owner of the Carthage electric-light plant, is installing a dynamo and oil engine to supply energy to maintain day load. All material has been purchased.

COVINGTON, IND.—Improvements to the municipal electric-light plant, involving an expenditure of $2,500, have just been completed, and include replacing all street arc lamps with nitrogen incandescent street lamps, rebuilding Ide engine, etc. Charles A. Baldwin is clerk.

GREENFIELD, IND.—The city of Greenfield has contracted with the Indiana Tank & Boiler Works for the erection of a new smoke stack, 5 ft. in diameter by 100 ft. high, to be built of ingot iron. E. C. Wolfe is superintendent.

NAPPANEE, IND.—A 300-kw. Westinghouse geared turbo-generator (condensing) is being installed at the municipal electric-light plant. Myron D. Kizer is manager.

NOBLESVILLE, IND.—The Noblesville Heat, Light & Power Company has purchased and will install about Nov. 1 one 300-kw., engine (unaflow type), driven generating unit, with condenser and switchboard equipment. All material has been purchased. John T. Kester is manager.

SHELBYVILLE, IND.—The Manufacturers' Association is considering the construction of an electric power plant in Shelbyville. The cost is estimated at $200,000.

ASHLEY, ILL.—The municipal electric-light plant will be sold at auction on the first Friday in October. James G. Clark is city clerk.

BLOOMINGTON, ILL.—Repairs to the municipal electric distribution lines are under consideration. C. C. Williams is superintendent.

FISHER, ILL.—The village officials are considering the installation of water-works system in connection with the municipal electric-light plant. A. L. Baker is engineer in charge.

FLORA, ILL.—The Municipal Light and Water Department contemplates installing an alternating-current generator (directly connected) and a motor generator set in the municipal electric-light plant; also motor-driven deep well pumps, the latter to replace air-lift system now in operation. C. L. Wheeler is managing engineer.

GALENA, ILL.—Extensive improvements have been made to the plant of the Interstate Light & Power Company of Galena this year, and include the installation of one 3000-kw. turbo-generator, two 600-hp. boilers, three 1000-kw. transformers and necessary auxiliary equipment, including pumps, switchboard extensions, coal conveyor, etc. The company will build a 1500-kw. substation and increase the output of another from 1500 to 3000 kw. Necessary extensions are being made to its lines to take care of the increased load.

LITCHFIELD, ILL.—The property of the United Gas & Electric Company of Litchfield has been taken over by the Southern Illinois Light & Power Company of Hillsboro.

MOLINE, ILL.—Contract has been placed by the Peoples Power Company of Moline for a 20,000-kva. Westinghouse turbo-generator, complete, with all auxiliaries for delivery next August. Installation will require the replacing of present 35-ton traveling crane with a 75 or 100-ton crane and the erection of a 60-ft. addition to power house engine room. D. G. Porter is assistant general manager.

MURPHYSBORO, ILL. — Murphysboro Water Works Company is to let the contract for a new power and pumping station.

SANDWICH, ILL.—The installation of a municipal electric-light plant is under consideration for which bonds have been issued.

STERLING, ILL.—The Illinois Northern Utilities Company, the Freeport (Ill.) Railway & Light Company and the Tri-County Light Company of Aledo have been consolidated and will be operated under one head. The new arrangement, it is understood, will result in the construction of a new steam power plant in Dixon.

STOCKTON, ILL.—The Stockton Electric Company has recently installed a 20-hp. semi-Diesel engine connected to a 37½-kva., three-phase, 60-cycle, 2300-volt Westinghouse generator. C. M. Smith is manager.

URBANA, ILL.—The Urbana Light, Heat & Power Company is installing two Heine boilers in its power house. John A. Glover is general superintendent.

WELDON, ILL.—All service furnished by the municipal electric-light plant is to be changed to meter rates by Sept. 1, 1916. A new boiler will be installed in the municipal plant as soon as material arrives. The main line has been moved 1½ blocks on Main Street to alley in rear. George Gallaher is engineer and electrician.

MERRILL, WIS.—The Wisconsin Valley Electric Company is changing its local distributing system from direct to alternating-current and is installing generating equipment in the old power plant of the Lindauer Pulp & Paper Company. The new plant will have an output of 1200 hp.

BUFFALO, MINN.—The municipal electric generating plant has been closed down and is for sale. Energy for operating the municipal electric system is purchased from the St. Cloud Public Service Company. R. A. Pickruhn is superintendent.

FERGUS FALLS, MINN.—The installation of an ornamental lighting system in Fergus Falls is contemplated.

GOOD THUNDER, MINN.—The Good Thunder Electric Company contemplates a 2-mile extension from its hydroelectric dam at Rapidan, discarding same, and making direct connection with plant at Rapidan dam. Contracts have been made with the Northern States Power Company to do this work. Material required for the proposed extension will include about 6 miles of No. 6 bare copper wire, insulators, 8-ft. crossarms and lightning protection at dam. F. H. Griffins is secretary.

BRITT, IOWA.—The Britt Light & Power Company is installing a new 100-hp. Murray boiler and has recently completed 500 ft. of reinforced concrete tunnel for steam heating pipes. L. M. Goodman is president and manager.

LAMONI, IOWA.—The Lamoni Electric Company is erecting a transmission line to Grand River, and will be completed about Sept. 1.

PANORA, IOWA.—The Council is considering a proposal submitted by the Iowa Light & Power Company of Cedar Rapids for the purchase of the municipal electric-light plant. If the proposition is accepted the company will erect a high-tension line from Perry to Panora via Dawson, Jamaica, Herndon and Yale.

REMSEN, IOWA—The property of the Remsen Electric Light & Power Company has been purchased by the Iowa Light, Heat & Power Company.

KANSAS CITY, MO.—Work has begun on the erection of a new power plant for the Ford Motor Works in Kansas City. It is understood that assembling plant of the Ford Company here will be greatly enlarged.

RAVENWOOD, MO.—A franchise has been granted to the Maryville (Mo.) Electric Light & Power Company to extend its transmission line to Ravenwood and to install a distribution system here.

ST. JOSEPH, MO.—At an election to be held Sept. 27 the proposal to issue $85,000 in bonds to rebuild the municipal electric-light plant will be submitted to the voters. Stevens & Stiles, 222 Commerce Building, Kansas City, Mo., are engineers.

URICH, MO.—The owners of the local electric-light plant are planning to rebuild the plant, recently destroyed by fire, temporarily, so as to supply electricity during the Urich reunion. Later a permanent structure will be built over the machinery.

JAMESTOWN, N. D.—Work has started on the erection of a new $65,000 plant for the Western Electric Company.

MINOT, N. D.—A franchise is reported to have been granted to F. J. Lizkowski for the installation of an electric plant in Minot. Orders, it is understood, have been placed for equipment for the plant.

RAY, N. D.—The local electric-light plant, owned by Charles A. Summers, is reported to have been purchased by A. H. Myer of Ortonville. Improvements, it is understood, will be made to the system.

BRUCE, S. D.—The purchase of the local electric-lighting system is under consideration by the city officials.

WAUBAY, S. D.—The Waubay Motor Sales Company is contemplating the installation of a 50-kw., three-wire, 125/250-volt generator. J. A. Hawkins is manager.

BARNSTON, NEB.—Preliminary plans are being prepared for the construction of a hydro-electric plant on Blue River at Barnston. G. W. Steinmeyer of Beatrice is interested.

DIXON, NEB.—The contract for the construction of the proposed municipal electric-light plant has been awarded to the Alamo Engine & Supply Company of Omaha, at $8,918.

HARRISON, NEB.—L. J. Price of Casper, Wyo., has been granted permission to construct and operate an electric-light plant in Harrison.

IMPERIAL, NEB.—Preliminary plans are being prepared by Grant & Fulton, Bankers Life Building, Lincoln, engineers, for the construction of an electric-light plant and water-works system in Imperial, to cost about $30,000.

PLYMOUTH, NEB.—Preliminary plans have been started by the Plymouth Electric Company for the construction of power house, 40 ft. by 60 ft., and distribution system, one story and basement, to cost about $5,000. The Martz Engineering Company, Orpheum Building, Lincoln, Neb., has charge of the engineering work.

STERLING, NEB.—A company is being organized under the name of the Sterling Light & Power Company to take over the local plant and improve it. W. W. Marks is interested.

CONWAY SPRINGS, KAN.—The Conway Springs Electric & Ice Company is installing a 50-hp. oil engine and generator (belted) and two switchboard panels, 1 mile of new line, 28 ornamental cast-iron lamp standards and has also moved poles from Main Street for a distance of 4500 ft. D. De Tar is manager.

KANSAS CITY, KAN.—Bids will be received by A. C. Ridell, purchasing agent, municipal electric plant, until Aug. 29, for six sets of electrolytic lightning arresters and six 1000-kva. transformers and also for erection of steel generator foundation.

PRETTY PRAIRIE, KAN.—J. J. Siebert, owner of the local electric-light plant, is changing the system from single to three phase.

RESERVE, KAN.—The City Council is considering calling an election to submit to the voters the proposal to erect a transmission line to Hiawatha.

WAMECO, KAN.—The distribution system of the municipal electric-light plant has been rebuilt; the lines removed from streets to alleys, heavier copper used in most parts, new transformers installed. Standards for ornamental lamps on two blocks will probably soon be purchased. D. A. Course is superintendent.

WATHENA, KAN.—The town of Wathena is contemplating rebuilding the lines of the municipal electric-lighting system and installing an electrically-operated fire bell. Charles A. Fetter is chairman.

WELLSVILLE, KAN.—The Wellsville Electric Light, Power & Ice Company is contemplating the installation of a second unit, consisting of a Diesel engine or a semi-Diesel engine with generator and necessary accessories. Plans not yet decided upon either as to size of unit or make C. A. Smith is owner.

Southern States

BADIN, N. C.—The Tallahassee Power Company, controlled by the Aluminum Company of America of Pittsburgh, Pa., it is reported, has purchased extensive acreages and is preparing to construct a power dam on Yadakin River at Gunsmith Shoals, 6 miles below Badin. It is reported that another hydroelectric development is also contemplated. Arthur V. Davis, Oliver Building, Pittsburgh, Pa., is managing official.

KERNERSVILLE, N. C.—Arrangements are being made for the installation of a municipal electric-light plant for which bonds were recently voted.

CAMDEN, S. C.—At an election to be held Sept. 12 the proposal to issue $7,000 in bonds will be submitted to the voters.

PORT ROYAL, S. C.—Bids will be received at the quartermaster's department, United States Marine Corps, Washington, D. C., until Aug. 28, for furnishing at the marine barracks at Port Royal, S. C., one continuous bake oven. Proposal blanks and other information may be obtained upon application to the above office.

UNION, S. C.—The Union & Glenn Springs Railroad Company, it is reported, has awarded contract to the Hugh L. Miller Company, New York, N. Y., represented by J. P. Miller at Union, for the reconstruction of railway and hydroelectric at Neal Shoals, damaged by the recent flood. The work will include construction of 500 ft. concrete and heavy timber dam across Broad River's new channel; which left original plant dry; dam 20 ft. high and will replace old fill which held railway's tracks. The cost of the work is estimated at $150,000.

BRUNSWICK, GA.—The Mutual Light & Water Company of Brunswick has been authorized by the State Railroad Commission to increase its capital stock by $163,250, of which the proceeds of $35,000 will be used for the installation of a new power plant. Contracts have been placed with the General Electric Company for a 625-kva. three-phase, 60-cycle steam turbine generator.

GAINESVILLE, GA.—The Etowah Milling & Power Company, recently organized with a capital stock of $500,000, is contemplating a water power development on Etowah River, 18 miles from Gainesville. John P. Given, president of the Consolidated Petroleum Company, 160 Broadway, New York, N. Y., is president; Jackson H. Simm, vice-president, and Dan S. Walraven is acting secretary and treasurer, both of Atlanta, Ga.

MADISON, GA.—Repairs are contemplated to the lines of the municipal electric-light plant, to cost about $200. G. W. Hubbard is superintendent.

STATESBORO, GA.—A 250-hp. Babcock & Wilcox boiler has recently been installed in the municipal electric-light plant. Daniel L. Gould is superintendent.

PALATKA, FLA.—G. Loper Bailey has been granted a franchise to erect electric transmission lines in the county to supply electrical service.

ST. PETERSBURG, FLA.—Extensions and improvements, it is reported, are contemplated by the St. Petersburg Electric Light & Power Company, which will double the capacity of its plant.

BRISTOL, TENN.—A franchise to bring electric power and lighting current to Bristol is being sought from the City Council by Fred Dulaney and others, who are developing a power plant on the Holston River.

CARTHAGE, TENN.—The city has sold a franchise to W. P. Eaves to construct an electric lighting system.

ATMORE, ALA.—The W. M. Carney Mill Company is considering the erection of a transmission line, 3½ miles long, into the farming district. The company started the erection of a line to Canoe Station, but abandoned it owing to the high price of copper. Fred Sintes is manager of the electrical department.

JASPER, ALA.—The Alabama Power Company of Birmingham is negotiating for the purchase of the property of the Jasper Water, Light & Power Company.

BOONEVILLE, MISS.—The property of the Booneville Light & Water Company has recently been purchased by John J. Kaye. The plant has been overhauled and a new 10-ton ice plant added. A new 25-hp., two-cycle, crude oil engine is needed to replace the 10-hp. gas engine in use.

ASHDOWN, ARK.—The Ashdown Ice & Power Company is just completing the construction of a new power plant and ice factory, at a cost of $20,000. The equipment includes two 85-hp. De La Vergne oil engines and Sterling ice machine. R. W. Linquette is manager.

HARRISBURG, ARK.—The Harrisburg Electric Light & Power Company contemplates erecting an addition to its plant and installing additional equipment to supply electricity to industrial plants.

NASHVILLE, ARK.—The city officials are considering the purchase of the local electric-light plant, owned by W. J. Risinger.

PORTLAND, ARK.—A franchise has been granted to B. O. Cummings to install and operate an electric-light plant in Portland.

SHREVEPORT, LA.—Bids will be received by the City Commission, City Hall, Shreveport, La., until Sept. 5, for construction of a water-works pumping station and filtration-softening plant, including pumping machinery and appurtenances. Plans and specifications are on file in the office of John B. Hawley, consulting engineer, City Hall, Shreveport.

LAMONT, OKLA.—The City Council is considering the question of granting a franchise to install an electric plant in Lamont.

SHAWNEE, OKLA.—The Shawnee Gas & Electric Company is considering the erection of an electric transmission line from Shawnee to Ada, Okla., a distance of 80 miles.

AUSTIN, TEX.—The Attorney General's department has approved a $34,000 bond issue of the city of Port Arthur for a fire alarm system. Bonds are serial and bear 5 per cent interest.

MARLIN, TEX.—A movement is on foot to obtain additional lighting throughout the city, and other extensive lighting improvements.

MARLIN, TEX.—The Marlin-Temple interurban Railway Company is making the final survey for its proposed interurban electric railway that is to run between Marlin and Temple, a distance of 35 miles, S. D. Hanna is chief engineer.

PORT ARTHUR, TEX.—The State Attorney General's department has approved an issue of $34,000 bonds, the proceeds to be used in installing an electric fire alarm system here.

TAHOKA, TEX.—A franchise has been granted to E. L. Howard to construct and operate an electric-lighting plant in Tahoka.

Pacific States

PUGET SOUND, Wash.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Sept. 30, for installing generator sets furnished by the government, and furnishing and installing boilers, condensers, pumps, motors, switchboard equipment, piping, wiring, lighting, etc., for the heating and power plant at the naval torpedo station, Puget Sound, Wash. Plans and specifications may be obtained by applying to the above bureau or to the commandant of the navy yard at Bremerton, Wash.

SEATTLE, WASH.—J. D. Ross, superintendent of lighting, announces that two substations will be erected by the Municipal Lighting Department. Both structures will be of reinforced concrete, to cost about $75,000. Plans will be prepared at once by Daniel Huntington, city architect.

SALEM, ORE.—The Idaho Power Company has been granted permission to transact business in the State of Oregon. John A. Laing of Portland is representative of the company in Oregon.

LOS ANGELES, CAL.—The Pacific Power Corporation, a subsidiary of the Nevada-California Power Company, is building a large plant on Silver Lake, costing approximately $100,000. It will consist of two units and will generate 16,000 hp. Another $1,000,000 plant is being started on Leovining Creek.

RICHMOND, CAL.—The Great Western Power Company has a contract with the Standard Oil Company of California for service amounting to 3000 hp. at the Point Richmond refinery. This was erroneously reported as being held by the Western States Gas & Electric Co.

KENDRICK, IDAHO.—The Potlatch Electric Company of Kendrick is contemplating 11,000-volt apparatus, including insulators, pins, disconnecting switches, fuses, lightning arresters, 11,000 to 2300-volt transformers (pole type), pole hardware, etc. A. V. Dunkle is secretary and manager.

POCATELLO, IDAHO.—A committee, composed of R. H. Palmer, Joseph Burns and J. A. Tupper, has been appointed to prepare resolutions requesting the City Council to ascertain whether the Southern Idaho Water Power Company would sell its distributing system in this city, and in event of its refusal to proceed with plans for the establishment of a municipal lighting plant.

TWIN FALLS, IDAHO.—The City Council has entered into a contract with the Idaho Power & Light Company for lighting the city for a period of ten years. The new contract provides for the installation of a new street-lighting system, consisting of 48 new units, at a cost of about $10,000.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 28, for furnishing mouthpieces for speaking tube, nickel-plated brass brackets, nickel-plated brass shelf supports and glass shelves. For further information address the above office.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Aug. 28, for furnishing structural steel for lumber and steel storage shed and Garun hydro-electric extension, and dynamite. For further information address Major Earl I. Brown, general purchasing officer.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until Sept. 6, for sheet steel, or iron, chain blocks, snatch blocks, electric motors, copper cables, chain bolts, metallic tapes, oil cans, oilers, etc. Blanks and general information pertaining to this circular (No. 1073) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,194,353. CAR AND ELECTRIC COUPLING; T. R. Brown, Sparkill, N. Y. App. filed March 11, 1914. Has manually operated means for controlling the coupling.

1,194,354. ELECTROLYTIC AND SAPONIFYING PROCESS FOR PRODUCING NITRITE DERIVATIVES; J. E. Bucher, Coventry, R. I. App. filed Feb. 23, 1915. Production of oxamid for fertilizing purposes.

1,194,357. TELEGRAPH TRANSMITTER; A. D. Cardwell, N. Y. App. filed Jan. 15, 1913. Accurate and rapid, typewriter construction (65 claims).

1,194,365. PRINTING TELEGRAPH RECEIVER; A. F. Dixon, Newark, N. J. App. filed March 20, 1914. One of the reproducing mechanisms may be rendered operative and inoperative at will.

1,194,367. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; B. G. Dunham, Hawthorne, N. J. App. filed June 7, 1915. Interval of waiting time is reduced to minimum.

1,194,371. SELECTIVE SIGNALING SYSTEM; J. Erickson, Chicago, Ill. App. filed June 24, 1912. Improved selector for train dispatching.

1,194,386. ELECTRICAL SWITCH; B. D. Horton, Detroit, Mich. App. filed March 22, 1913. High-capacity, armor-clad, for heating irons, etc.

1,194,429. GUARD FOR TROLLEY WHEELS; P. R. Schafer, Brownfield, Pa. App. filed Oct. 25, 1915. Can be released for switching from one trolley to another.

1,194,437. CARBURETER ATTACHMENT; F. McC. Starbuck, Washington, D. C. App. filed Sept. 26, 1913. Electrical heater which permits use of kerosene.

1,194,438. PROCESS FOR SEPARATING METALS; R. H. Stevens, Salt Lake City, Utah. App. filed Nov. 20, 1912. Separation of cadmium, bismuth and tellurium.

1,194,439. SIGNALING DEVICE FOR VEHICLES; A. R. Suhner and J. D. Coakley, N. Y. App. filed March 19, 1915. Slidably projected signals at opposite sides of car.

1,194,444. SELF-WINDING CLOCK; W. J. Van Osdel, Chicago, Ill. App. filed Sept. 20, 1915. Simple structure with improved base.

1,194,447. SWITCH; H. Walker and W. L. Kreuscher, Anaheim, Cal. App. filed Aug. 23, 1915. Particularly for automobile indicators.

1,194,448. SEMAPHORE; H. Walker, Anaheim, Cal. App. filed Oct. 23, 1915. Automobile signal.

1,194,451. THEATER DIMMER; H. J. Wiegand, Milwaukee, Wis. App. filed March 12, 1906. Rack or pinion connection between operating lever and contact arm.

1,194,457. THEATER DIMMER; H. J. Wiegand, Milwaukee, Wis. App. filed March 12, 1906. Construction enabling all operating levers being placed on same shaft.

1,194,457. TELEPHONE RECEIVER; B. D. Willis, Chicago, Ill. App. filed Aug. 25, 1913. Maximum inductance produced by the weakest current met with in practice.

1,194,458. DERRICK AND HOD SIGNALING SYSTEM; H. A. Yates, N. Y. App. filed Aug. 8, 1912. Records the orders transmitted.

1,194,470. ALTERNATING-CURRENT RECTIFIER; D. M. Bliss, West Orange, N. J. App. filed April 28, 1911. Utilizes all or any portion of each half wave.

1,194,497. BATTERY AND CONTAINER; E. A. Hawthorne, Bridgeport, Conn. App. filed June 22, 1914. Admits air to the enclosed battery cell.

1,194,500. BATTERY CHARGING PANEL; A. J. Horton, White Plains, N. Y. App. filed May 26, 1913. Either one or two rheostats may be used independently.

1,194,517. PHOTO-PLAY ORCHESTRAL DIRECTOR; S. W. Lawton, N. Y. App. filed Sept. 28, 1915. Indicates music to be played at different stages in "feature" play.

1,194,524. SELECTIVE SIGNALING MEANS; J. McFell, Chicago, Ill. App. filed May 9, 1912. Devices at all receiving stations are responsive to a universal call.

1,194,525. ELECTRIC SIGNALING MEANS; J. McFell, Chicago, Ill. App. filed Dec. 21, 1912. For calling persons in a department store, or the like.

1,194,537. AUTOMOBILE SIGNALING SYSTEM; A. H. Otis, Cleveland Heights, Ohio. App. filed Sept. 14, 1914. Operates automatically upon turning, throwing out clutch or shifting to reverse to display respective signals.

1,194,543. TROLLEY WHEEL CONSTRUCTION; J. H. Reese, Butler, Pa. App. filed March 30, 1915. Prevents trolley wheel sliding to one side off the wire.

1,194,564. SWITCHING MECHANISM; H. A. Steen, Norwood, Ohio. App. filed March 23, 1912. Potential starter having abnormal circuit and time element attachment.

Record of Electrical Patents

Notes on United States Patents issued August 15, 1916, prepared by Mitchell & Allyn, 41 Park Row, New York.

1,194,565. PORTABLE WRAPPING MACHINE; W. C. Stevens, Akron, Ohio. App. filed April 12, 1913. For wrapping tires or elements in coil form.

1,194,571. FIRE ALARM SYSTEM; F. A. Swan, Cliftondale, Mass. App. filed Nov. 5, 1913. "Auxiliary" system.

1,194,600. SIGNAL BOX; F. W. Cole, Newton, Mass. App. filed Aug. 6, 1914. Operated by a "pull."

1,194,606. ELECTRIC ARC FURNACE FOR THE TREATMENT OF GASES; C. O. A. Doyle, Notodden, Norway. App. filed May 10, 1915. Oxidation of nitrogen.

1,194,607. COMBINED ELECTRIC LIGHTING AND STARTING APPARATUS FOR MOTOR VEHICLES; L. Duca and E. Naldini, Turin, Italy. App. filed April 12, 1915. Parts combined to occupy minimum space.

1,194,643. INCANDESCENT LAMP; H. Kreusler, Berlin-Wilmersdorf; H. Gerdien, Berlin-Schmargendorf, and M. von Pirani, Berlin-Wilmersdorf, Germany. App. filed Sept. 22, 1914. Carbon filament in a gas filling.

1,194,645. VARIABLE SPEED ELECTRIC MOTOR; J. C. Lincoln, Cleveland, Ohio. App. filed May 2, 1905. Particularly designed for lathes.

1,194,663. COMBINED ELECTRIC STOVE AND TOASTER; G. E. Reinking, Fort Wayne, Ind. App. filed Jan. 4, 1916. Has coacting grate sections which can be brought together for toasting or lowered for cooking.

1,194,668. SIGNALING DEVICE; C. Schatzle and E. Smith, Palmerton, Pa. App. filed Sept. 13, 1915. Corner signaling operated by approaching vehicles.

1,194,671. REPULSION MOTOR GENERATOR; K. Schnetzler, Baden, Switzerland. App. filed Nov. 3, 1910. Prevents production of dangerous currents.

1,194,683. ELECTRICAL REGULATOR; A. A. Tirrill, Pittsburgh, Pa. App. filed March 3, 1914. Has resilient means connecting two regulating levers.

1,194,688. STORAGE BATTERY; T. A. Willard, Cleveland, Ohio. App. filed July 6, 1915. Terminal post automatically sealed by act of assembling.

1,194,690. TELEPHONE AND TELEGRAPH POLE CONSTRUCTION; H. E. Adams, Pittsburgh, Pa. App. filed Feb. 19, 1914. Tubular casing on cross-arm.

1,194,714. RAILWAY SIGNALING SYSTEM; C. J. Coleman, N. Y. App. filed Sept. 22, 1908. For electric railways.

1,194,715. RAILWAY SIGNAL; J. P. Coleman, Edgewood Borough, Pa. App. filed Jan. 31, 1914. Biased semi-coil with motor for swinging it.

1,194,721. SERVICE OBSERVING SYSTEM; H. L. Darrah, Chatham, N. J. App. filed Nov. 26, 1915. By which service on a plurality of telephone lines may be observed from the central point.

1,194,723. FIRE ALARM APPARATUS. D. G. Dee, Rochester, N. Y. App. filed July 25, 1912. Gives a distinctive signal over the telephone line.

1,194,741. AUTOMATIC TELEPHONE SYSTEM; H. H. Ide, Chicago, Ill. App. filed June 19, 1914. Operations controlled by differential relays.

1,194,747. INSULATOR; H. R. Kells, New York, N. Y. App. filed Dec. 3, 1915. Provision to keep water from traveling along wire.

1,194,765. TELEPHONE RECEIVER; D. P. Moore, Washington, D. C. App. filed July 30, 1913. Loud speaking construction in which diaphragm is not unduly stressed.

1,194,778. ELECTRIC CURRENT MODIFIER; V. Paquit, Stapleton, N. Y. App. filed Oct. 22, 1914. Collectors having rings co-operating with brushes.

1,194,783. BRAKE SYSTEM FOR MOVING VEHICLES; G. Rennerfelt, New York. App. filed July 16, 1909. Foot pressure is dependent upon movement of vehicle and power which drives it.

1,194,785. WATER HEATER; S. G. Roberts, Boston, Mass. App. filed March 3, 1915. Steam pressure controlling the electric heater is automatically regulated.

1,194,808. TEMPERATURE INDICATING OR RECORDING SYSTEM AND APPLIANCE; A. Barry, Liverpool, England. App. filed Jan. 31, 1914. Accurately records temperatures from a distance.

1,194,818. SEPARATOR FOR BATTERIES; R. N. Chamberlain, Chicago, Ill. App. filed Sept. 19, 1913. Wood coated with insulating material.

1,194,820. MULTIPLEX RADIOTELEGRAPH SYSTEM; E. H. Colpitts, East Orange, N. J. App. filed Sept. 11, 1915. Overcomes commutation difficulties.

1,194,851. AUTOMATIC TELEPHONE SYSTEM; A. E. Lundell, New York, N. Y. App. filed Jan. 14, 1916. Switching devices controlled over single non-talking conductor.

1,194,856. SIGNAL DEVICE; J. Mark, Chicago, Ill. App. filed Feb. 7, 1916. Operated by clutch and brake pedals.

11,94,880. METER ADAPTER; J. Sachs, Hartford, Conn. App. filed July 27, 1915. Can be made to conform to various kinds of meters.

1,194,881. METER ADAPTER; J. Sachs, Hartford, Conn. App. filed July 27, 1915. Encloses meter and protects the wires.

1,194,882. CLIP; J. Sachs, Hartford, Conn. App. filed July 27, 1915. For cartridge fuses.

1,194,883. METER TESTING APPLIANCE; J. Sachs, Hartford, Conn. App. filed Oct. 9, 1915. Constructed after the manner of a cut-out block.

1,194,886. ELECTRIC WATER HEATER; M. Simon, St. Louis, Mo. App. filed June 1, 1915. Especially arranged heating units.

1,194,888. VEHICLE SIGNAL; J. Spaerer, Newark, N. J. App. filed Sept. 23, 1915. Combined direction annunciator and taillight casing.

1,194,906. METHOD AND APPARATUS FOR SINTERING METAL; R. B. Walling, Newark, N. J. App. filed Oct. 7, 1912. Tungsten for manufacture of filaments.

1,194,911. TIME SYSTEM; J. C. Wilson, Boston, Mass. App. filed Nov. 4, 1912. Special make and break contacts.

1,194,914. SIGNAL; F. W. Wood, N. Y. App. filed Oct. 5, 1914. For sounding a whistle at predetermined intervals.

1,194,923. ALTERNATING CURRENT COMMUTATOR MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Sept. 11, 1914. Has particularly desirable torque characteristics.

1,194,928. CLOCK REWINDING DEVICE; C. Auer, Fragaria, Wash. App. filed Dec. 14, 1915. Porter for moving the collar weight forms a part of said weight.

1,194,931. SIGNAL BOX; C. E. Avery, Trenton, N. J. App. filed Feb. 3, 1915. Mechanical construction of signaling mechanism.

1,194,940. MAGNETIC TREATMENT OF METALS; F. L. Bishop, Pittsburgh, Pa. App. filed Jan. 2, 1914. Treats metals magnetically while heated to recalescence point.

1,194,957. INSULATOR; H. H. Cochrane, Butte, Mont. App. filed April 21, 1915. Built-up construction with sealed-in replacable fibrous core.

1,194,959. TELEPHONE INSTRUMENT; A. L. Cotton, Brunswick, and J. S. Wicking of Oakleigh, Victoria, Australia. App. filed May 10, 1915. Can be locked to prevent the sending of messages.

1,194,970. AUTOMATIC CONTROLLING SYSTEM FOR ELECTRIC GENERATORS; A. E. Doman, Elbridge, N. Y. App. filed Jan. 11, 1911. Particularly for automobiles and the like.

1,194,981. ELECTRIC RAILWAY SIGNAL; H. J. Faubel and W. Roach of Alliance, Ohio. App. filed June 25, 1915. Operated by flange of rail.

1,195,003. CATTLE GUARD; A. Gwynn, Lucerne, Wyo. App. filed Oct. 13, 1915. Includes an electric horn or other alarm.

1,195,011. STATION INDICATOR; F. Healy, Petrolia, Ontario, Canada. App. filed April 22, 1915. Pushing a button causes indication of next station.

1,195,032. PORTABLE ELECTRIC LAMP; E. W. Lamb, Lansing, Mich. App. filed Feb. 26, 1916. Can readily be made of wood.

1,195,060. MAIL BOX ALARM; J. G. Menow and H. Meyer, Santa Rosa, Cal. App. filed April 26, 1915. Deposit of mail in any one of nested mail boxes gives signal.

1,195,079. ELECTRICAL CONNECTOR CLIP; J. G. Peterson, Jersey City, N. J. App. filed May 6, 1914. Spring arms with holes which can be brought into register.